

The Effectiveness of Home-Study Driver Education Compared to Classroom Instruction: The Impact on Student Knowledge, Skills, and Attitudes

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OF THE STATE OF CALIFORNIA**

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CHAPTER 206, 1999-2000 LEGISLATIVE SESSION**

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13. ABSTRACT (Maximum 200 words) Home-study driver education programs exist in several states, but none have been scientifically evaluated to determine if such courses are as effective as classroom-based courses for teaching driver education. Almost 1,500 students were randomly assigned to receive classroom instruction, a CD ROM home-study course, a workbook home-study course, or an internet/workbook home-study course. Few differences were found on exit exam knowledge and attitude scores, but tended to favor the CD and internet/workbook home-study courses over the workbook or classroom courses. Differences favoring classroom courses on department written test outcomes likely reflect bias in such courses towards teaching test-specific material. The findings present no compelling evidence that home-study courses are less effective than classroom courses for teaching driver education. The findings could result in more widespread use of home-study courses. The use of low-cost home-study courses as the first stage of a two-tiered driver education program could make such programs more feasible and acceptable to the public.				
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PREFACE

This report was completed to fulfill the requirements of Senate Bill 946 (Vasconcellos, Chapter 206, 1999–2000), which required the department to conduct a study comparing the knowledge levels and attitudes of teenagers who completed driver education in a classroom course with those of teenagers who completed a home-study course (CVC §12814.8). The report was prepared by the Research and Development Branch of the California Department of Motor Vehicles under the administration of Cliff Helander, Chief.

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EXECUTIVE SUMMARY

Introduction

- The main goal of driver education and training is to teach new drivers the knowledge, skills, and attitudes necessary for operating a motor vehicle safely and passing the written and behind-the-wheel driving tests required to obtain a driver license.
- Although driver education in California has typically been taught in a classroom, Senate Bill 946 (Vasconcellos, 1999; California Vehicle Code §12814.8) required the department to complete a study comparing the knowledge levels and attitudes of teenagers who complete driver education in a classroom course with those of teenagers who complete a home-study course. The law required three types of home study to be compared to classroom: an interactive computer-based course, a paper-based workbook course, and a preexisting course utilizing computer or paper-based methods, or both. This report presents comparisons of the knowledge and skill levels and safe-driving attitudes of students completing these home-study courses with those of students taught in a classroom environment.

Literature Review

Computers in Driver Education Courses

- The American Driver and Traffic Safety Education Association recognizes the existence of internet driver education courses and specified typical components of such courses, suggesting that there is growing acceptance of using home-study driver education courses as an alternative to classroom instruction.
- Although complete driver education computer-based programs exist, none have been scientifically evaluated.

Prevalence of Home-Study Driver Education

- Even though there have been no recent evaluations of the effectiveness of home-study driver education for novice drivers, home-study driver education in one form or another is not uncommon. For example, California, Connecticut, Florida, Minnesota, Nevada, New Mexico, Oklahoma, Texas, and Virginia currently accept some form of home-study driver education as meeting requirements for their teenage driver license applicants.
- Although the California Department of Motor Vehicles (DMV) has historically not considered home-study driver education to be legal for meeting the requirements for an instruction permit in California, there are now a myriad of different home-study driver education courses that claim to issue certificates that are acceptable in California because they function under the umbrella of a private secondary school.

- The completion certificates from these private secondary school-affiliated home-study driver education programs are required to be accepted by the California DMV as a result of a recent court ruling (*Jackson v. Gourley*, 2003). In addition, the curriculum of such programs is not regulated by the Department of Education due to recent changes to §51852 of the California Education Code (SB 2079, Burton, 2002).

Research on Home-Study Driver Education

- Only one contemporary study was found that even mentioned home-study driver education for teens (Preusser, Ferguson, Williams, Leaf, & Farmer, 1998). That study recommended that graduated licensing systems “favor” home-study driver education and training and the subsequent importance it places on parental involvement in, and control of, their teen’s licensing.

The Safety Value of Driver Education and Training

- There is evidence that formal training through driver education and driver training increase the knowledge and skill levels of teens (but not necessarily their safe-driving attitudes), even if these knowledge and skill gains do not translate into lower crash risk.
- Although driver education and training are commonly considered to have safety value for reducing teen crash and violation rates, the preponderance of research both in California and throughout the world does not support this view. Traffic safety researchers concede that driver education and training, even when well designed and rigorous, have not been shown to reliably reduce the crash rates of young drivers.
- Past reviewers have consistently concluded that formal training leads to earlier and increased licensure for young drivers, which tends to cause increases in crashes and violations that outweigh any potential safety benefits gained through improvements in knowledge and skill.

Ideas for Improving Driver Education and Training

- In addition to proposing integrating driver education and training with graduated licensing programs, increasing the time that teens spend practicing on the road, and making driver education multi-staged with separate courses in the learner and provisional stages of licensing, some traffic safety researchers have recommended that driver education courses make use of emerging technology such as interactive, self-paced computer-based training.

Method

Selection of Participating Driving Schools

- Twenty provider schools were initially selected to participate in the study and 10

additional schools were later selected from the alternates list in an attempt to increase the volume of students participating in the program.

Administration of Instruction Methods

- Every driving school participating in the study was required to administer all four types of driver education instruction: (a) classroom instruction, (b) a computer CD-ROM home-study course, (c) a workbook home-study course, and (d) the Private Educational Network (PEN) workbook/internet home-study course.
- The content of all four courses was based on a standardized driver education curriculum created by subject matter experts from the California DMV and California Polytechnic State University, San Luis Obispo.
- The provider schools determined which type of driver education instruction each student was to receive using random assignment methods created by the department.

Outcome Measures for Study Comparisons

- After students in the study completed their driver education course, they were required to return to the provider's school site within 2 weeks to take a DMV-proctored exit examination. The exams were proctored every 2 weeks at most school sites.
- The 60-item exit examination was created by the department for use in the study and contained three different sets of items: (a) 40 items to measure knowledge of rules of the road and safe driving practices as presented in the standardized curriculum, (b) 15 items to measure driver attitudes, and (c) 5 items to evaluate the students' opinions about the courses. The exit test represented the best and most reliable criterion for evaluating the relative effectiveness of the different courses because of its closer proximity to course completion, the high level of security in its administration, the fact that it contained subject matter sampled from the entire driver education curriculum, and there being more students who completed the study exam than completed the DMV written test by the end of the study.
- The second criterion measure used to compare the relative effectiveness of each of the courses was the students' first-attempt pass rates for the 46-item DMV written knowledge test.
- It was also intended to compare the students completing the various courses on their pass rates for their first-attempt drive tests, but too few subjects (4.6%) completed a drive test by the end of the study to make comparisons among the courses feasible. This low percentage is likely due to the mandatory 6-month waiting period required by California's graduated licensing law prior to teens being able to take a behind-the-wheel drive test.

Results

Study Subjects

- Of the 1,493 driver education students who volunteered and were enrolled in the study, the comparisons for the exit exam knowledge scores, exit exam attitude scores, and first-attempt DMV written test pass rates are based on the 1,321 students who completed their course by the end of the data collection period.
- Several statistical comparisons were made in the study. The various comparisons were necessary to assess the effectiveness of the various courses after ruling out potential biasing effects of deviations from study procedures, simultaneous enrollment in driver training, and computer ownership, which could be considered to be related to socio-economic status and parental level of education. Although the general pattern of results over the various comparisons was of primary interest, the most valid comparisons of the instruction methods were those involving students who were correctly assigned and were not enrolled in driver training. Therefore, it is the results for these comparisons that are presented below.

Exit Exam Knowledge Comparisons

- Figure 1 presents the mean exit exam knowledge scores of the instruction methods for students correctly assigned and not enrolled in driver training. The results of comparing the exit exam knowledge scores of these students did not indicate a statistically significant difference in the knowledge levels of students completing the home-study courses compared to those completing classroom instruction ($ps > .05$). The results did suggest that the students completing the CD-ROM and PEN courses had higher knowledge levels than did those completing the workbook course.

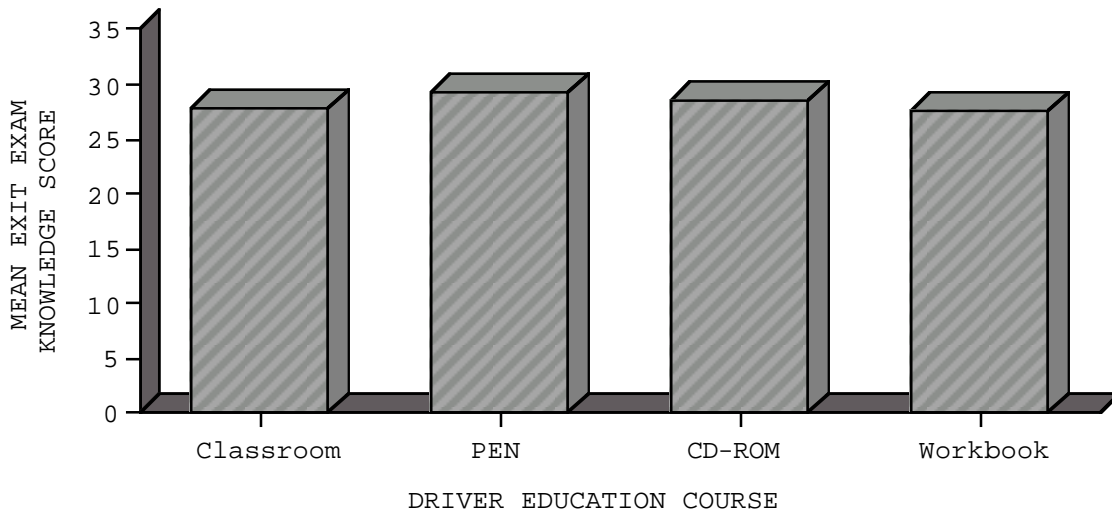


Figure 1. Mean exit exam knowledge score by instruction method for students correctly assigned to the courses and not enrolled in driver training.

Safe-Driving Attitude Comparisons

- The mean safe-driving attitude scores of the instruction methods for students correctly assigned and not enrolled in driver training are presented in Figure 2. The results did not indicate any statistically significant differences in the safe driving attitudes of students completing the home-study courses compared to those completing classroom instruction, or between any of the home-study courses ($ps > .05$).

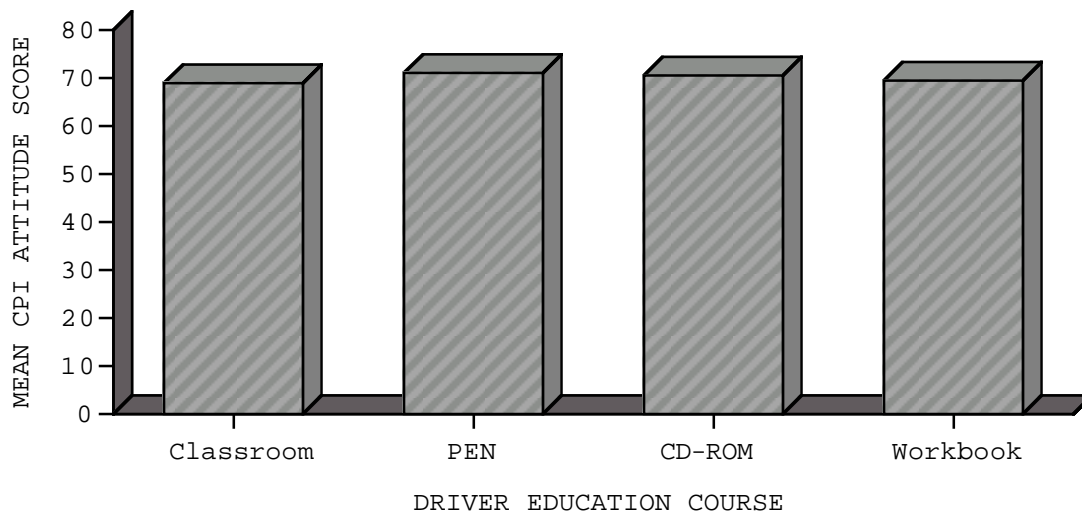


Figure 2. Mean safe-driving attitude score by instruction method for students correctly assigned to the courses and not enrolled in driver training.

DMV Written Knowledge Test Pass Rate Comparisons

- The first-attempt DMV written knowledge test pass rates of the instruction methods for students who were properly randomly assigned and were not enrolled in driver training are shown in Figure 3. The findings indicate that the students who completed classroom instruction passed the written test at a significantly higher rate on their first attempt than did students in either the CD or workbook courses. The fact that the observed 12.4% lower pass rate for PEN students compared to classroom students was not statistically significant is quite possibly a result of low power due to the small sample size of PEN students ($n = 44$) used in this comparison, rather than there being no true difference between the groups' performances on the written test. Statistical power refers to the ability to detect a difference between the means when the difference actually does exist.

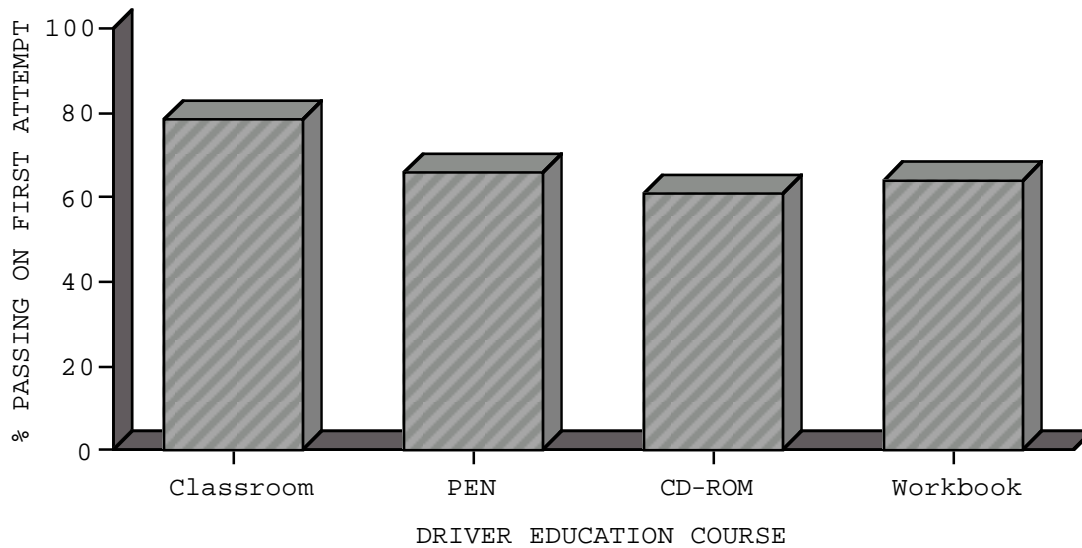


Figure 3. First-attempt DMV written knowledge test pass rate by instruction method for students correctly assigned to the courses and not enrolled in driver training.

Conclusions

- Any bias in the study results caused by students dropping out of the study following course assignment would be minimal given the very low frequency of its occurrence (1.9%).
- A higher percentage of students assigned to classroom instruction (12.4%), and an even higher percentage of students assigned to the PEN course (24.1%), failed to complete their course by the end of the study compared to those assigned to either the CD-ROM (6.3%) or workbook (6.2%) instruction methods. This factor may have biased the results of the evaluation in favor of the PEN course, and to some extent, classroom instruction. However, although the lower course completion rate for classroom students would have tended to favor them in the comparisons, the results of the comparisons did not show this outcome.
- Based on the overall pattern of findings it is concluded that the home-study driver education courses were just as effective as classroom instruction for teaching the driver education curriculum material. This decision was heavily influenced by the fact that home-study students performed just as well or better than classroom students on the study exit examination knowledge and attitude outcome measures. Given the fact that the study exit examination covered much more of the material in the driver education curriculum than did the DMV written test, it represented a

much more content-valid measure for comparing the effectiveness of the different courses.

- The findings in this study do not provide any compelling evidence against using home study as an option for teens taking driver education in California. Although the courses evaluated in this study represented a number of different modalities for teaching home-study driver education, and the findings suggest that computer-based courses are more effective than workbook courses, even students who completed the workbook course did not have a lower level of knowledge or worse attitudes compared to classroom students.
- Because of the evidence that students who completed the courses involving computer-based and internet instruction performed better on the study exit examination than did students in the workbook and classroom courses, the findings in this regard suggest that using interactive technology to teach driver education resulted in superior learning, consistent with recommendations by some traffic safety researchers for improving the effectiveness of driver education in general.
- The use of home-study interactive courses as part of a multi-staged driver education system integrated into graduated licensing programs may make such a system more feasible. Such courses, once made, should be relatively inexpensive, therefore placing minimal demand on the finances and time of parents. Home-study courses may also have the additional benefit of increasing parental involvement in their teen's learning process, which has been shown to be an important factor in the effectiveness of graduated licensing laws in general.

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INTRODUCTION

Driver education and behind-the-wheel driver training exist throughout the world and are commonly a prerequisite for a driver license by licensing agencies to mitigate the high crash risk of novice teen drivers (Anderson, Abdalla, Goldberg, Diab, & Pomietto, 2000; Mayhew & Simpson, 1996, 2002). The main goal of these formal instructional courses is to teach new drivers the knowledge, skills, and attitudes necessary for safely operating a motor vehicle and passing the written and behind-the-wheel driving tests required to obtain a driver license (Anderson et al., 2000; Mayhew & Simpson, 1990, 1996, 2002).

Among other requirements, teenagers younger than 18 years old who wish to obtain a driver license in California must first obtain an instruction permit issued by the California Department of Motor Vehicles (DMV). With the implementation of California's graduated licensing program in July 1998, teens are required to hold their learner's permit for a minimum of 6 months, complete 50 hours of supervised on-the-road instruction (beyond the 6 hours typically required for completion of driver training), and are restricted from driving with passengers younger than 20 years old during the first 6 months after licensure and from driving between midnight and 5:00 am during the first 12 months after licensure. To obtain the instruction permit, teens must have completed or be simultaneously enrolled in both driver education and driver training courses or have completed driver education and be enrolled in driver training, and must pass both the vision and written knowledge tests. To obtain their provisional driver license they must pass a drive test. Driver education and training courses in California have historically been taught by: (a) private commercial driving schools licensed by the DMV, (b) public secondary schools (public high schools), and (c) private secondary schools (private high schools).

Although driver education in California has typically been taught in a classroom, Senate Bill 946 (Vasconcellos, 1999) required the department to complete a study comparing the knowledge levels and attitudes of teenagers who complete driver education in a classroom course with those of teenagers who complete a home-study course (CVC §12814.8). (A copy of the legislation is shown in Appendix A.) The law required that the types of home study to be compared include an interactive computer-based course, a paper-based workbook course, and a preexisting course utilizing computer or paper-based workbook methods, or both. This report presents comparisons of the knowledge and skill levels and attitudes of students completing these home-study courses with those of students taught in a classroom environment. Hence, the study results provide information about the relative effectiveness of the different methods of delivering a driver education course, not about whether any of the driver education courses have any safety value *per se*.

The legislation enabling the evaluation of home-study driver education specifies that at least 8,000 students were to participate in the pilot project, with approximately 2,000 in each of the four course types being compared. The law required the department to recommend in writing by January 1, 2002 that the project be terminated if it was determined that the required number of students could not be obtained. The training of students was to occur from January 1, 2001 through December 31, 2002, but due to

uncontrollable delays in developing the home-study courses to be used in the evaluation, it was not possible to begin training until December 2001. In spite of this late start in training students, it was decided that it would still be possible to meet the 8,000 student requirement by the end of the data collection period. Therefore, the department did not submit a letter to the Legislature recommending termination of the project. Unfortunately, interest in the project turned out to be less than anticipated and it was not possible to obtain 8,000 subjects for the study by the end of the data collection period. Slightly fewer than 1,500 students enrolled in the study, but this was determined to be adequate to provide sufficient statistical power to detect meaningful differences between the four programs on the measures being compared (study exit exam average score and DMV written and drive test fail rates). It was therefore decided to complete the evaluation and submit the findings to the Legislature by means of this report.

Literature Review

Computers in Driver Education Courses

The American Driver and Traffic Safety Education Association (ADTSEA), working with the National Highway Traffic Safety Administration (NHTSA), state driver licensing agencies, and driver education and training professionals throughout the country, developed several documents for the purpose of defining improved models of driver education and training. One of these documents recommended specifications for classroom instruction, using computer-based simulators and other instructional programs in conjunction with classroom courses, and for internet-based driver education courses (ADTSEA, 2000). Although they recommended that computer-based simulators, narrative instructional programs, and decision-making programs be used only to enhance, not to replace, a classroom course, they did endorse on-line internet courses as an acceptable alternative to classroom courses, as long as they are based upon the most current driver education curriculum available. In their specifications for internet driver education courses, they provide a list of the components of a typical internet course, such as using email for communication purposes, having on-line quiz and testing components, and presenting the course material through a variety of different mediums (e.g., videos, graphics, and links to web pages). The fact that this national driver education organization recognized the existence of internet courses and specified typical components of such courses suggests that there is growing acceptance of using home-study driver education courses as an alternative to classroom instruction. Their endorsement of using computer-based programs and simulators in the classroom also indicates a clear recognition that computer-based instruction can be effective at teaching some of the material deemed important for novice driver education.

The idea of using computers to help teach safe driving has been around since personal computers became widely available in the 1980s (Opfer, 1985). A number of stand-alone driving-related instructional computer programs, simulators, and interactive games have been created by public agencies, private companies, and educational institutions for purposes of teaching some of the material in a driver education course. For example, the Federal Highway Administration (FHA) created a CD-ROM program called "Moving Safely Across America: The Interactive Highway Safety Experience" that presented interactive simulations and testing to increase awareness of motoring

safety. Similarly, Montana State University, in conjunction with the Montana Department of Transportation, distributed over 11,000 “Montana Rules” CD-ROM programs to middle and high schools in 2002. The program is an animated game that teaches teens about road safety and is meant to help prepare them to take the written knowledge test, not replace their driver education course (Jamie Cornish, personal communication, April 4, 2003). Other examples of stand-alone programs include those that teach about drinking and driving (Vermont’s Crash Site CD-ROM interactive drinking and driving program), hazard recognition and risk taking (the Automobile Association of America’s driver-Zed CD-ROM; Blank & McCord, 1998), pedestrian safety (the FHA’s Safer Journey CD-ROM), responsible driving (Sierra On-Line’s Driver’s Education ’99), and general driving laws and principles (the Go-Driver interactive CD-ROM, and the city of Fort Lauderdale’s Smooth Operator Program internet and CD-ROM components).

There is some research indicating that these types of programs can be effective at teaching specific driver-education relevant content and skills. For example, Fisher et al. (2002) found that teens completing a computer-based risk-awareness training program evidenced less-risky driving than did untrained teens on a driving simulator. However, these programs tend to be piecemeal, focusing on some, but not all, of the curriculum content that is required in a typical driver education course. Consistent with the recommendations by ADTSEA (2000), the limited and “gamey” nature of these programs makes them appropriate as supplements to a complete driver education course, rather than as comprehensive surrogates. Although more complete computer-based programs exist (e.g., Imaginatics’ Cyberdriver: Graduate to Safety, Driver Ed in a Box by www.drivedinabox.com, the Rules of the Road DVD by www.gooddriverdvd.com, and the First-Time Driver Course by www.4newdrivers.com), none have been scientifically evaluated. The CD-ROM and internet courses evaluated in the current study were based on the same standardized curriculum used in the classroom and covered all of the same areas that were covered in the classroom course.

Prevalence of Home-Study Driver Education

This study is the first to evaluate home-study driver education courses for teens since Moukhwass and Simonnet (1975) evaluated programmed instruction booklets over 25 years ago and found them to be effective for self-instruction. The lack of research on non-classroom methods of driver education is surprising given that home-study learning has been part of formal education since 1833 in the form of correspondence courses (Sherow & Wedemeyer, 1990). Home-study programs have been shown to be successful and viewed positively in other areas besides novice driver education (Berube, 1995; Boyle, 1998; Fender, 2002). Even though there are no evaluations of the effectiveness of home-study driver education for novice drivers, home-study driver education in one form or another is not uncommon. For example, California, Connecticut, Florida, Minnesota, Nevada, New Mexico, Oklahoma, Texas, and Virginia currently accept some form of home-study driver education as meeting requirements for their teen license applicants. Connecticut allows parents to teach driver education and driver training to their children, and they may use a commercial home-study course for this purpose. Texas explicitly allows both parent-taught and commercially available home-study driver education and driver training courses. Virginia and

Minnesota allow parents to home-school their children in driver education through several correspondence courses, and this method is explicitly deemed to be acceptable by the licensing agencies in these states. There is also evidence that other states have students trained through home-study driver education programs associated with private secondary schools, even if it is not explicitly stated in their laws. The California DMV is currently conducting a survey of all states to identify others that allow home-study driver education and training. Two past surveys of driver education practices in the United States conducted by other researchers found that less than 50% of the states even require driver education for new drivers (Jernigan, Stoke, & Alcee, 1992; Oates, 1986). Those that do require driver education typically only require it for teens under a certain age (usually 18) who are applying for a first-time license (Jernigan et al., 1992).

Although the California DMV has historically not considered home-study driver education to be legal for meeting the requirements for an instruction permit in California, there are now a myriad of different home-study driver education courses that claim to issue certificates that are acceptable in California because they function under the umbrella of a private secondary school. The completion certificates from these private secondary school-affiliated home-study driver education programs are required to be accepted by the California DMV as a result of a recent court ruling (*Jackson v. Gourley*, 2003). In addition, the curriculum of such programs is not regulated by the Department of Education due to recent changes to §51852 of the California Education Code (SB 2079, Burton, 2002). It should be noted that these recent changes to California law could not have affected the results of the current evaluation because they came after the data collection had ceased.

Research on Home-Study Driver Education

Only one contemporary study was found that even mentioned home-study driver education for teens (Preusser, Ferguson, Williams, Leaf, & Farmer, 1998). This study compared the ages at which teens obtained their instruction permits and first licenses in four contiguous states with different teen licensing laws (Delaware, Connecticut, New York, and New Jersey), as well as the relationship of teen licensure rates to a number of personal, social, and family-related variables. They found that teen licensure rates in Connecticut, which allows home-study driver education, were the most strongly related to personal and family variables such as GPA, living with both parents, and having at least one college-educated parent. They recommended that graduated licensing systems “favor” the Connecticut home-study option and the subsequent importance it places on family involvement in, and control of, their teen’s licensing (Preusser et al., 1998). Other traffic safety researchers have come to recognize the importance of parental involvement and supervision in the early stages of their children’s learning to drive, which may even increase the effectiveness of graduated licensing programs for reducing teen crash risk (Graham, 2002; Hartos, Eitel, Haynie, & Simons-Morton, 2000; Lonero & Clinton, 1996; McPherson, 2002; Robinson, 2001; Saunders, 1998; Simons-Morton, 2002; Simons-Morton & Hartos, 2003; Simons-Morton, Hartos, & Leaf, 2002; Simpson, 1996). Hence, to the extent that home-study driver education provides a resource for increased parental involvement in the learning-to-drive process of their children, it may become an important part of graduated licensing laws, possibly as the first course in driver education under the sort of multi-stage driver education program recommended by traffic safety researchers (Lonero & Clinton, 1996; Lonero et al., 1995;

Mayhew & Simpson, 1999, 2002; McKnight, 1984; NHTSA, 1994; Williams & Mayhew, 2003).

The Safety Value of Driver Education and Training

There is evidence that formal training through driver education and driver training increase the knowledge and skill levels of teens (but not necessarily their safe-driving attitudes), even if these knowledge and skill gains do not translate into lower crash risk (Kersey, 1976; Martinez, Martin, Levine, & Altman, 1993; Mayhew & Simpson, 1996; McKnight, Goldsmith, & Shinar, 1981; Ohio Department of Education, 1974; Page-Valin, Simpson, & Warren, 1977; Riley & McBride, 1975; Stock, Weaver, Ray, Brink, & Sadof, 1983).

Although driver education and training are commonly considered to have safety value for reducing teen crash and violation rates, the preponderance of research both in California and throughout the world does not support this view (Anderson et al., 2000; Mayhew & Simpson, 1996, 1999, 2002; NHTSA, 1994; Peck, 1985, 1996). Traffic safety researchers concede that driver education and training, even when well designed and rigorous, have not been shown to reliably reduce the crash rates of young drivers (e.g., Mayhew & Simpson, 1996, 2002; Peck, 1985, 1996). For example, in a comprehensive review of 30 studies on driver education, behind-the-wheel driver training, motorcycle training and education programs, and advanced training courses for novices, Mayhew and Simpson (1996) found that there is little evidence in the literature supporting the idea that driver education or driver training reduce violation or crash rates. That is, the majority of the evidence they reviewed did not indicate that students who completed formal training programs had fewer subsequent crashes and violations than did students who did not have such training. Their conclusions have been supported by the findings of four other independent reviews (Christie, 2001; Roberts, Kwan, & Cochrane Injuries Group Driver Education Reviewers, 2002; Vernick et al., 1999; Woolley, 2000). Past reviewers have consistently concluded that formal training leads to earlier and increased licensure for young drivers, which tends to cause increases in crashes and violations that outweigh any potential safety benefits gained through improvements in knowledge and skill (Christie, 2001; Mayhew & Simpson, 1996, 2002; Roberts et al., 2002; Vernick et al., 1999; Woolley, 2000).

Besides the fact that driver education and training lead to higher and earlier licensure rates, other explanations as to why driver education and training have failed to result in safety benefits are: (a) the courses fail to teach the knowledge and skills that are critical for safe driving in teens, (b) the students in the courses are not motivated to use the safety skills that they do learn, (c) completing the courses fosters overconfidence in students, (d) the courses fail to adequately address teenage lifestyle issues such as risk-taking, and (e) the courses are one-size-fits-all that do not tailor the safety content to individual student needs (Mayhew & Simpson, 2002).

Ideas for Improving Driver Education and Training

Just because driver education and training do not result in crash reductions does not necessarily mean they should be abandoned (Mayhew, 2003; Mayhew & Simpson, 1999). On the contrary, traffic safety researchers recommend that they be changed to

focus on the development of skills that are more important to safety and find more effective methods for teaching the courses (Mayhew & Simpson, 1999, 2002). In addition to integrating driver education and training with graduated licensing programs, increasing the time that teens spend practicing on the road, and making driver education multi-staged with separate courses in the learner and provisional stages of licensing, it has been recommended that driver education courses make use of emerging technology such as interactive, self-paced computer-based training (Anderson et al., 2000; Gregersen, 1996; Lonero, 2001; Lonero & Clinton, 1996; Lonero et al., 1995; Mayhew & Simpson, 1996, 1999, 2002; Mayhew, Simpson, Williams, & Ferguson, 1998; McKnight, 1984; McKnight & Peck, 2003; NHTSA, 1994; Robinson, 2001; Saunders, 1998; Waller, 1986; Williams, 2001; Williams & Mayhew, 2003). Regarding this last suggested improvement, one expert stated, “participational and interactive teaching methods are widely seen as desirable in general education, and they are now both desirable and feasible for driver education” (Lonero, 2001, p. 20). This view seems consistent with the recommendations made by ADTSEA (2000), and makes sense given that the use of interactive computer-based programs and the internet are two technologies that have made it easier to effectively educate students through home-study programs (Fender, 2002). Another expert recommended computer- and video-based accelerated driver improvement programs for young drivers to make the accelerated driver improvement programs recommended for graduated licensing programs more cost effective (Peck, 2001). Computer-based driver improvement schools have existed in California for many years (e.g., internet traffic violator schools) and are accepted by various courts in the state as valid educational programs, although they have never been scientifically evaluated.

The computer-based (CD-ROM) driver education home-study course evaluated in this study seems to fit this final suggestion for improving driver education, as it represents an integration of interactive multimedia training and testing into a self-paced driver education course (Anderson et al., 2000; Lonero, 2001; Lonero & Clinton, 1996; Mayhew & Simpson, 2002; Robinson, 2001; Smith, 2001). In addition, many students enrolled in the Private Educational Network (PEN) course, one of the other home-study courses in this evaluation, completed their courses via the internet (Beck, 2002). In all fairness, the traffic safety researchers (with the exception of ADTSEA) were probably recommending that computer and internet technology be used to supplement rather than replace classroom-based driver education courses (e.g., Palmer, 2001). However, it was suggested by one expert that using self-directed, self-paced teaching methods, such as those afforded by these home-study programs, may be more effective than conventional classroom instruction for teaching the highest-risk young drivers, as conventional classes may bore these students in the early stages of learning to drive (Lonero, 2001). Further, novice driver education programs utilizing computer-based technologies may provide a higher level of interaction with the student and more accommodating scheduling than conventional classroom-based instructional programs (Fender, 2002; McKnight, 2001).

Home-study instruction may actually be more effective than classroom instruction for teaching the basic knowledge objectives in early driver education courses given that home-study courses remove distracting classroom influences from peers, may increase parental involvement in their children’s driver education instruction, may be more beneficial for teens who are at the highest risk, and may benefit from the novelty of

using modern, interactive, and self-paced teaching and testing technology (Lonerio, 2001; Lonerio & Clinton, 1996; Simpson, 1996). As stated above, computer-based learning and other self-instruction materials could be an integral part of first-stage driver education in the multi-stage system that has been advocated for integrating driver education and training with graduated licensing programs (Lonerio, 2001; Lonerio & Clinton, 1996; Lonerio et al., 1995; Mayhew & Simpson, 1999, 2002; McKnight, 1984; NHTSA, 1994; Robinson, 2001; Williams, 2001). Because of the low cost associated with home-study courses, they may make such a two-stage driver education and training process more acceptable to parents and legislators. To this end, the findings of this study do provide some information about the relative effectiveness of using interactive multimedia technology and testing to teach driver education.

METHOD

The evaluation mandated by Senate Bill 946 (Vasconcellos, Chapter 206, 1999–2000, CVC §12814.8) specifically requires the department to compare safe driving knowledge and attitude exit examination scores, DMV written test results, and DMV drive test results for teens administered driver education through one of the following methods: (a) classroom instruction, (b) an interactive computer program, (c) a printed home-study course, and (d) a preexisting home-study course. The procedures used to select driver education provider schools and collect the information necessary for the evaluation are described below.

Selection of Participating Driving Schools

Solicitation of Schools

The law permitted only commercial driving schools to be considered for participation as education providers in the study. Letters were sent to all California commercial driver education schools in February 2000. This letter introduced the study and provided information on how participating schools were to be selected, how the instruction methods were to be administered, the requirement that the same fee amount be charged for each method of instruction in the study, and the data collection and reporting procedures. The schools were asked to respond to an attached survey questionnaire if they were interested in possibly being selected as a provider school. The questionnaire was also used to obtain information relevant to the subsequent selection of the sample schools, such as their monthly training volumes.

In March 2000 another letter was sent to all commercial driving schools inviting them to attend one of three industry meetings held in Los Angeles, Fresno, and Dublin, California at the end of March 2000. At these meetings the department presented the implementation plan for the study and the requirements of participating schools. Comments from the schools were gathered at the meetings and considered by the department in establishing the final study plan and procedures. The schools interested in participating were given an application form at the meetings. Application forms were also mailed to all schools responding to the February 2000 questionnaire. The

applications were used to capture information about the number of students each school trained monthly, whether the school had multiple training sites, the location of the school administration office and each training site, the classroom capacity at each site, and days and times that the classrooms were available for the department to use to conduct exit examinations. The applications were due by the end of April 2000.

Initial Sample of Schools

The selection of provider schools was based on the following criteria: (a) their willingness to participate in the study and comply with all regulations, (b) their having taught a classroom-based driver education course in California, (c) their being in good standing with the department's Occupational Licensing Program, (d) the estimated number of students under age 18 they trained monthly, and (e) the geographic location of the school in California. Provider schools were not considered at all for inclusion in the study if they failed to meet any of the first three criteria.

It was intended to choose schools that widely represented the geographical regions of California. Therefore, the applications were clustered into regions of the state (using the eight California DMV field office regions) and rank-ordered within each region from the highest to lowest number of students under age 18 trained by the school monthly. The initial list of candidate schools consisted of the top three volume schools in each region that trained at least 30 students per month. Because field office Regions I and VII had only two schools meeting these initial criteria, and Region V had only one such school, the initial pool of selected schools was 20. The 20 selected provider schools were sent study agreement contracts and trained in-person in the written study procedures.

Changes to the Sample of Schools over the Course of the Study

The ranked nonselected eligible candidate schools in each region were used as alternates. During the study, four of the initial 20 schools opted to no longer participate in the study and were replaced by the next-best alternate within the field office region. In June 2002, 10 additional schools were selected from the alternates list to bring the total number of participating schools to 30. This was done in an attempt to increase the volume of students participating in the program.

Administration and Description of Instruction Methods

The content of all four courses was based on a standardized driver education curriculum created by subject matter experts from the California DMV and California Polytechnic State University, San Luis Obispo. It was necessary that all courses covered the same basic information to ensure that the questions on the exit exam and written tests administered to all study students upon completion of their driver education courses would fairly represent the material taught across all four courses. The standardized curriculum was divided into 10 different chapters, each presenting all of the content material for that subject area in a lecture-ready format. The curriculum also

included tables, graphics, and suggestions for writing questions to test student knowledge during the courses.

Every driving school selected as a provider for the study was required to administer all four types of driver education instruction: (a) classroom instruction, (b) a computer home-study CD-ROM course, (c) a workbook home-study course, and (d) the Private Educational Network (PEN) home-study course. The CD computer program and workbook home-study courses were developed for use in the study and were provided to participating driving schools at no cost along with the PEN course, which the department purchased from PEN. A description of each of these courses is provided below.

Classroom Course

The legislation required the department to include a driver education program in the classroom environment under direct supervision of an instructor as required in Chapter 1 of Division 5 of the California Education Code (CEC). The classroom instruction course was the usual 30-hour in-class course provided by the schools. However, the study schools were required to use the department's standardized driver education curriculum as the basis for the course instead of the school-written and DMV-approved lesson plans that were being used before. With the exception of this restriction on the curriculum, the schools were allowed to teach the class in a manner consistent with their prior business practices, including the choice of videos and other supplementary instructional materials. The classroom course represented the control condition to which all the other courses were compared to evaluate their relative effectiveness.

DMV Computer-Based CD-ROM Course

The legislation also required that the study include a driver education program licensed under CEC Chapter 1 (commencing with §11100) of Division 5 selected by the DMV to present a home-study course using an interactive, computer-based program that follows a model curriculum approved by the department. The computer-based course used in the study was created for the DMV by Sky's The Limit Interactive, a computer-based training vendor. The course content was based on the standardized driver education curriculum. The course consisted of a self-loading CD-ROM program that presented the course material in the order it appeared in the standardized curriculum. The course included pre-and-post quiz questions for each chapter of the curriculum (except the first chapter), short videos, interactive activities, and other multimedia. After a student completed all the course chapters and passed the end-of-chapter quizzes at an acceptable level, the program allowed the user to print a "Certificate of Course Completion" that served as evidence of course completion when presented to the provider schools. To guard against fraud, each CD program included a validation sticker that was required to be affixed to this certificate before it was acceptable by the school. The certificate also had to be signed by the student and his or her parent/guardian attesting that the student completed the course alone. DMV research staff provided technical support for the CD program during the course of the study.

DMV Paper-Based Workbook Course

The third instruction method mandated by the legislation was a driver education program licensed under CEC Chapter 1 (commencing with §11100) of Division 5 selected by the department to present a home-study course using printed materials based upon a model curriculum approved by the department. The paper-based course used in the study was a home-study workbook developed for the DMV by Sky's The Limit Interactive. The workbook presented all of the content material in the order it was presented in the standardized curriculum. It also used pre-and-post quizzes for each chapter (except the first), and had short educational activities to be completed by the student throughout the workbook. Parents were required to sign after each chapter quiz verifying that their child had completed the quiz on his or her own and had reviewed the material for missed questions. The workbook also had a 36-item end-of-course test that the students were to complete at home. The parent/guardian was required to sign the end-of-course test certifying that the student had completed the test on his or her own without assistance from others. The student returned the test to the driving school that issued the course to be graded. The student was required to correctly answer at least 70% (25) of the questions on the end-of-course test to pass the course. Alternative forms of the end-of-course test were available at the provider schools to use for subsequent test attempts when the student did not pass the test. Each workbook also included a Certificate of Course Completion with an affixed validation sticker. A student was deemed to have completed the course when they passed the end-of-course exam and provided a Certificate of Course Completion with a parent/guardian signature.

Preexisting Internet or Workbook Home-Study Course

The final course required by the legislation was a driver education program that used printed materials or computer-based delivery methods, or both, and that met all of the following requirements: (a) the program had operated using a home-study format for not less than 4 years, (b) the program had provided a minimum of 2,000 hours of driver education, as described in CEC subdivision (j) §51220, and the principal of the school held a driving school operator's license issued by the department, and (c) the program was being offered by a California private secondary school. To find a program that met these requirements, the department sent a Request for Information to 3,800 potential providers, including public and private secondary schools and commercial driving schools licensed by the department. The only provider who responded that met the legislative criteria for this program was the Private Educational Network (PEN).

The PEN home-study program was available to students in the study in either workbook or internet format. PEN was given time to update their course to make it compliant with the standardized driver education curriculum upon which the other three courses in the study were based. Both the workbook and internet PEN programs present the material primarily in text format with chapter activities (generally fill-in-the-blank questions) graded by PEN. The courses also included an end-of-course test that the students were required to pass to finish the course, which was graded by PEN staff. Unlike the other instructional methods, the PEN course also involved additional fees under certain circumstances. For example, although all four methods of instruction required students to complete their course within 30 days, only PEN charged additional

fees for students who finished late. Students who completed the PEN course 1 to 10 days late were required to pay \$15, those 11 to 30 days late were required to pay \$25, and those who were more than 30 days late were considered unconditional failures of the PEN course and were required to pay full enrollment fees to retake driver education. Students assigned to PEN who did not complete the course were considered to be dropouts and were not included in the statistical analyses for this study. (This procedure was also used for the other home-study courses as well, as explained in the Results section of this paper.) To pass the PEN course, the students had to complete the chapter activities, pass the end-of-course test, and pay any additional fees that were due within 60 days of receiving the course from a study provider school. PEN informed students by letter when they had passed the course and also mailed to the provider school that issued the PEN course a driver education completion certificate for the student.

Restriction on Course Fees

Provider schools were allowed to charge whatever fee amount they wanted for driver education as part of the study, provided that all students enrolled in the study at a given school paid the same amount regardless of the type of driver education instruction they were assigned to receive. The purpose of this requirement was to allow providers in the study to compete on price and at the same time eliminate any financial incentive for students to prefer receiving one type of instruction over another. Another advantage of having the same fee for each type of instruction in the study was that the student would know the cost of the instruction before the course fee was collected and before he or she was randomly assigned to an instruction method. The provider schools were also allowed to have a separate price structure for classroom driver education for students who did not want to participate in the study.

If a student refused to enroll in or complete the instruction program assigned, the schools were not required to refund the study course fee. Such students were, however, allowed to enroll in classroom instruction at the school as a non-participant in the study, and might have had to pay the regular non-study fee for the classroom instruction. Hence, students who refused to complete the study requirements were not necessarily given a refund, but were given the option of taking the classroom course or going to another driver education provider who was not part of the study. The numbers of students who dropped out of each instruction method for this reason are shown in the Results section. These students were not used in the statistical analyses for the study.

Provider School Procedures

Parent/Guardian Release Statement

For students at a participating provider school to be eligible to participate in the study, they must have been 15, 16, or 17 years old, able to read English at or above the 7th grade level, and not have been licensed previously. The schools provided eligible students who were interested in participating in the study with a Parent/Guardian Release Statement (shown in Appendix B). This document provided additional information about the study procedures and requirements, and was used to collect

information such as whether the student had access to a computer that met the minimum hardware and software requirements for the CD course.

School Project Log

When the completed Parent/Guardian Release Statement was returned to a provider along with the course fee, the schools entered the student's information on a School Project Log (shown in Appendix C), including the student's true full name, birth date, whether or not the student had access to the computer hardware and software necessary to run the CD program, and whether or not the student would be enrolled in driver training during enrollment in the study. Students who simultaneously enrolled in both driver education and driver training are eligible to take the DMV written license test before completing driver education, and therefore were excluded from the analysis comparing the four instruction methods on DMV written test outcomes. The coding for simultaneous enrollment on the School Project Log was used to identify students who needed to be excluded for this reason. These students were still to be included in various analyses of the study exit examination and DMV drive test results, although separate analyses are presented in the Results section to determine if simultaneous enrollment interacted with instruction method.

Random Assignment of Students

After entering the student's information on the School Project Log, the provider school determined which type of driver education instruction the student was to receive using a random assignment method created by the department. The provider schools were not allowed to divulge the random assignment scheme, nor to tell a student what type of instruction he or she was going to receive until after collecting the course fee and a signed Parent/Guardian Release Statement. The course assignment was based on the day of the month of the student's birth and whether or not the student's parent or guardian indicated (by a checkmark on the release statement) that he or she had access to a computer with the necessary hardware and software for the CD program. If the student had access to a computer that would allow the use of the CD program, he or she was eligible to be randomly assigned to any of the four instruction methods using Random Assignment Method I. Otherwise, he or she was eligible to be randomly assigned to one of the three instruction methods other than the CD program using Random Assignment Method II. After determining the type of instruction the student was to receive, the school indicated the selection by checking the appropriate box and writing the date that the assignment was made on the School Project Log. The home-study kits were then distributed to the students, or they were enrolled in the next available classroom course (if they were assigned to classroom instruction).

The three home-study kits were completed on different dates and therefore were distributed to the provider schools at different times during the study. As a result, there were actually three different pairs of random assignment schemes used during the course of data collection. The workbook was the first completed kit, and was distributed in December 2001. The CD program was distributed in February 2002 and the PEN course was distributed in July 2002. Hence, the random assignment schemes changed to include the new methods of instruction as they became available. The

changes in the random assignment scheme over the course of the study are shown in Table 1.

Table 1
Changes During the Study in the Day of Birth Random
Assignment Scheme for Each Method of Assignment

Day of birth	Instruction assignment	
<u>Random Assignment Method I (computer access)</u>		
	December 2001	
1-16		Classroom
17 or higher		DMV Workbook
	February 2002	
1-10		Classroom
11-20		DMV CD-ROM
21 or higher		DMV Workbook
	July 2002	
1-8		PEN Course
9-16		Classroom
17-24		DMV CD-ROM
25 or higher		DMV Workbook
<u>Random Assignment Method II (no computer access)</u>		
	December 2001	
1-16		Classroom
17 or higher		DMV Workbook
	February 2002	
1-10		Classroom
11 or higher		DMV Workbook
	July 2002	
1-8		PEN Course
9-16		Classroom
17 or higher		DMV Workbook

Outcome Measures for Study Comparisons

The legislation that mandated the study required the DMV to compare the study participants on the results of an exit examination and the pass rates for the DMV written and driving tests. The legislation required the exit examination to assess both traffic safety knowledge and driver attitudes. The materials and procedures used to collect data for each of these dependent measures are described in the following sections.

DMV-Proctored Exit Examination

After students in the study completed their driver education course, they were required to return to the provider's school site within 2 weeks to take a DMV-proctored exit examination before receiving a Certificate of Completion of Classroom Driver Education (OL 237 or DL 387). The exams were proctored every 2 weeks at most school sites and every week at the others. The proctors were selected from DMV employees at field offices near the schools and, in most cases, were trained in-person. The exit exams were not graded by the proctors and there was no "failing" score for the exam. However, every effort was made to ensure that the providers and proctors did not make this fact known to the students.

The provider schools were not allowed to see the content of the exit examinations to prevent them from coaching their students on the exam content. This 60-item examination was created by the department for use in the study and contained three different sets of items: (a) 40 items to measure knowledge of rules of the road and safe driving practices as presented in the standardized curriculum, (b) 15 items to measure driver attitudes along an internal-external locus of control continuum, and (c) 5 items to evaluate the students' opinions about the courses. The exit test represented the best and most reliable criterion for evaluating the relative effectiveness of the different courses because of its close proximity to course completion and high level of security in its administration. A copy of the exit examination is shown in Appendix D.

Knowledge Items

A pool of 120 knowledge items was written for the exit examination based on the material presented in the standardized driver education curriculum. The items were written so that the content covered by the exit examination would proportionately represent the content covered in the standardized driver education curriculum. That is, longer chapters had more knowledge questions on the exit examination than did shorter chapters. In addition, the items covered the general safety-related material in each chapter rather than esoteric details that would be idiosyncratic to the standardized curriculum such as specific word choice.

Three forms or versions of the exit examination with 40 knowledge items each were pilot tested at the beginning of the first day of classroom driver education at a local (Sacramento) licensed driving school in January 2001. The purpose of the pilot was to identify items that 40% or more of first-day driver education novices answered incorrectly to determine whether the exit examinations could discriminate between those who were knowledgeable of the subject matter and those who were not. Some items were modified or replaced based on the results of the pilot study to make them more difficult for novices. Form 1 of the revised exit examination was pilot tested again in February 2001 at the beginning of the first day of driver education at a different local licensed driving school. Based on the results of this second pilot study, a final Form 1 of the exit examination was created consisting of 40 knowledge items and the other items discussed in the next two sections.

The internal-consistency reliability of the exam was computed using the Kuder-Richardson formula (K-R 20). This type of reliability indicates the degree of uniformity among exam items and the extent to which the exam items measure a common domain

of knowledge. It also serves as a gauge of the overall precision of the exam as a measurement instrument. Coefficients closer to 1 are more desirable and .70 is commonly considered to be a minimum standard. The internal-consistency reliability of the knowledge questions on Form 1 of the exit examination was .49 based on data from 21 novice students in the second pilot study in February 2001. This low reliability coefficient was expected, given that the students did not have prior instruction in the content areas. A Cronbach's internal-consistency reliability coefficient of .67 was obtained for the students participating in this evaluation, indicating fairly satisfactory reliability. Forms 2 and 3 of the exit examination knowledge items and their accompanying item statistics were archived in case additional versions of the exit examination were needed during the course of the study because of breeches in test security, but it did not become necessary to use these additional forms.

Crash Proneness Internalization (CPI) Attitude Items

It was suggested long ago that intrinsic personality factors, such as perceived locus of control, might be a better criterion for evaluating driver education effectiveness than crash rates (Page-Valin et al., 1977). Locus of control refers to the degree to which people believe that the outcomes of life events they experience, such as being involved in crashes or receiving traffic tickets, are under their personal control or primarily due to chance factors (Rotter, 1966). Student attitudes about safe driving were measured using the CPI scale, which was created for use in this study. The CPI consists of 15 items created to measure driver attitudes that were modeled after Montag and Comrey's (1987) Driving Internality (DI) and Driving Externality (DE) Scales. The DI and DE scales were created to measure the extent to which individuals attribute crash involvement to themselves (DI) or to outside factors (DE). These driving-specific scales were created because researchers in other areas have achieved more success in relating locus of control to their specific areas of research when the items were modified to more specifically target the area (Montag & Comrey, 1987). The DI and DE scales' authors demonstrated that having more of an internal locus of control (DI) was associated with lower involvement in fatal crashes and having more of an external locus of control (DE) was associated with higher involvement in fatal crashes. A similar measure was successfully used by Gebers (1995) to measure attitude change for traffic violator school attendees, although subsequent correlations with crash and violation rates indicated small, non-significant relationships. Additional evidence for the relationship between crash proneness and locus of control comes from Jones and Wuebker (1985, 1988, 1993), who found that having more of an internal locus of control was associated with lower levels of job-related accidents, including those for bus drivers. Internal locus of control has also been shown to be related to lower crash propensity (Mayer & Treat, 1977), injuries (Sherry et al., 1996), employee accidents (Hansen, 1988, 1989), and injury-prone behavior (Marusic, Musek, & Gudjonsson, 2001).

Each of the 15 CPI items presents a driving-related attitude at one extreme of locus of control, such as "Crashes occur because drivers don't drive as safely as they should." Respondents were asked to indicate the extent to which they agree with each item on a 6-point scale ranging from 1 (*Strongly Disagree*) to 6 (*Strongly Agree*). Higher numbered responses indicate more of an internal locus of control for Items 1, 2, 4, 5, 7, 10, 12, 13, and 14. Items 3, 6, 8, 9, 11, and 15 are worded so that higher response values indicate a higher external locus of control and therefore needed to be recoded before calculating a total score of the attitude items. Total scores were calculated by summing responses to

all the items (after recoding the external items). Higher overall CPI scores indicate a more internal locus of control, and hence would be expected to be associated with safer driving. The overall Cronbach's internal-consistency reliability coefficient was .62 for the CPI scores for students in the study, which indicates an acceptable level of uniformity among the items.

Course Evaluation Items

The five course evaluation items included on the study exit test were intended to gather feedback for use in comparing the four instructional methods on their quality and likeability to students; they were not used to evaluate student knowledge or attitudes. The respondents were asked the degree to which they felt the course material was presented in an interesting manner, how easy it was to understand and follow the course materials, how well they felt the course prepared them to begin driving, the degree to which they felt their knowledge about driving increased because of the course, and whether they would recommend the course to others. Students indicated their responses using a 6-point scale, although the definitions of the highest and lowest scale values were different for each item (e.g., for one item the end points were Not at All and Very Well, while for another they were Absolutely Not and Absolutely Yes).

DMV Written Knowledge Test

The second criterion measure used to compare the relative effectiveness of each of the courses was the students' pass/fail performance on their first attempt taking the 46-item DMV written knowledge test (DL-5T), of which there are five equivalent forms. This test is required by the department for all driver license applicants under the age of 18, and must be passed to receive a behind-the-wheel instruction permit. Test takers are allowed to miss up to 8 items (i.e., they must answer at least 38, or 83%, of the items correctly) to receive a passing score on the test. The tests are evaluated annually by the DMV and items are reworded or revised to improve clarity, reliability, and relevancy. The latest statewide evaluation of the written knowledge test for minors indicated a .76 average internal-consistency reliability across the different versions of the test of, which indicates an acceptable level of consistency among the items on each form (Chapman & Masten, 2002). The study participants' pass/fail test outcomes for their first test attempt were captured electronically from the department's automated driver license record masterfile.

Applicants are allowed to apply for an instruction permit and take the DMV written knowledge test if they: (a) are age 15 years and 6 months or older and have successfully completed both driver education and behind-the-wheel driver training, (b) are age 15 years and 6 months or older and have completed driver education and are enrolled in driver training, or (c) are age 15 or older and are simultaneously enrolled in both driver education and driver training. Of these three circumstances, the third is problematic when the goal is to compare students on their performance on the DMV written test because students who are simultaneously enrolled in driver education and driver training are allowed to take the DMV written test before they complete driver education. This obviously makes students who simultaneously enrolled inappropriate candidates for evaluating the effectiveness of the different courses on the DMV written test measure. Therefore, these study participants were excluded from the comparison of DMV written test fail rates. In addition, the analyses involving the exit exam

knowledge and attitude outcomes were completed both with and without these simultaneously enrolled students to control for the influence of this problem. The DMV written test is considered to be an inferior outcome measure compared to the study exit examination results because the DMV written test only covers a small portion of the content in the standardized driver education curriculum, the amount of time after course completion that the students actually took to take their first DMV written test could have varied from 1 day to more than a year, and the additional loss of students resulting from students not taking the DMV written test by the end of the study.

DMV Drive Test

The legislation that mandated this study also required the department to compare the students completing the various courses on their DMV drive test outcomes. To meet this requirement, the students' pass/fail outcomes for their first attempt drive tests were electronically collected from the driver license record masterfile. However, drive test outcome is a poor measure of the relative effectiveness of the courses for the following reasons. First, students are required to also complete a driver training course before being allowed to take their drive test, and therefore any observed differences in drive test results could be due in whole or in part to the effect of driver training. Second, applicants are required to complete 50 hours of supervised driving before being allowed to take the drive test. This could similarly result in additional learning that could bias comparisons of driving skill levels resulting from the courses. Third, students are required to hold their instruction permits for at least 6 months before being allowed to take the DMV drive test. The influences of extraneous factors occurring during the long time period between driver education course completion and taking the drive test would likely obscure any differences in knowledge and skill levels resulting from completing the different courses. In addition, the students are likely to have forgotten much of the course material during the 6-month instruction permit period. For these and other reasons, the comparison of drive test outcomes has dubious validity for drawing conclusions about the differences among students who complete the four driver education courses, and little credence could be put in the results of these analyses.

RESULTS

Study Subjects

A total of 1,493 driver education students volunteered and were enrolled in the study. The total number and percentage of students assigned to each instruction method, and the numbers and percentages dropping out, failing to complete the course by the end of the study, and successfully completing each course are shown in Table 2. Only 28 (1.9%) of the participants refused to accept and complete the course they were assigned to receive. The percentage dropping out of each type of course ranged from 1.3% for the workbook to 2.5% for classroom and PEN. Results of a chi square test of independence (used to determine if the course types had different dropout rates) indicated that the dropout rate was not significantly different among the various instruction methods, $\chi^2(3, N = 1,493) = 2.05, p = .56$. There was no evidence to suggest that these students dropped out of the study to avoid a particular type of course or

because they did not want the course to which they were assigned. Any bias in the study results caused by these students dropping out would be minimal given the very low dropout frequency.

Table 2

Number (*n*) and Percentage of Students Who Enrolled in Each Instruction Method, Dropped Out, Did Not Complete the Course by the End of Data Collection, and Successfully Finished

Instruction method	Enrolled		Dropped out ^a		Did not complete ^b		Successfully finished	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
PEN	162	10.9	4	2.5	39	24.1	119	73.5
Classroom	356	23.8	9	2.5	44	12.4	303	85.1
CD-ROM	443	29.7	8	1.8	28	6.3	407	91.9
Workbook	532	35.6	7	1.3	33	6.2	492	92.5
Total	1,493	100.0	28	1.9	144	9.7	1,321	88.5

^aDropout rates were not significantly different, $\chi^2(3, N = 1,493) = 2.05, p = .56$. ^bNon-completion rates higher for PEN and classroom than for the CD-ROM or workbook, $\chi^2(3, N = 1,493) = 54.56, p < .05$.

Of the 1,493 students who enrolled in the study, an additional 144 students (9.7%) did not finish the course to which they were assigned by the end of the data collection period (February 2003), as evidenced by their failure to complete the study exit exam. A chi square test of independence was used to determine if one type of course was completed more often than another. The results of the analysis showed statistically significant differences in the course completion rates among the instruction methods, $\chi^2(3, N = 1,493) = 54.56, p < .05$. These results indicate that a higher percentage of students assigned to classroom instruction, and an even higher percentage of students assigned to the PEN course, failed to complete their course compared to those assigned to either the CD-ROM or workbook instruction methods. There are likely qualitative differences (for example possible different motivation levels) between the students who did and did not complete each course. Any potential bias introduced into the study results by this difference would be expected to have a stronger effect on comparisons involving PEN (because PEN has the highest noncompletion rate), and to a lesser extent, classroom instruction. In particular, the high PEN non-completion rate may be a result of the PEN end-of-course test being difficult, which would result in less-able students being screened out from taking the study exit examination and DMV written test.

Data Analysis Strategy

The comparisons for the exit exam knowledge scores, exit exam attitude scores, and first-attempt DMV written test pass rates are based on the 1,321 students who completed the study exit examination. The participating driving schools and number of valid students from each school is shown in Appendix E. It was not possible to

compare the students completing the four courses on their drive test pass rates because a drive test outcome was available only for 61 (4.6%) of the 1,321 students. This low number is likely due to the 6-month waiting period required by California's graduated licensing law prior to teens being able to take a behind-the-wheel driving test. The analysis of variance (ANOVA) technique was used to determine if there were any statistically significant differences between the four instruction methods on each remaining outcome measure. Tukey post-hoc multiple comparison tests were used as follow-up tests whenever an ANOVA was statistically significant, to determine exactly which of the course means differed from the others. An alpha level of .05 was used to determine the statistical significance of each omnibus ANOVA and the Tukey post-hoc tests. (An alpha level of .05 means that the differences are deemed significant if the probability of their occurrence by chance alone is less than 5 times in 100.) However, any mean difference with an observed significance probability level that was less than .10 was considered to be a "suggestive" finding.

Two different statistical comparisons were conducted for the study exit examination outcomes and also for the DMV written test. The first analyses, referred to as "Overall," compared the students in the four instruction methods as assigned by the driving schools, regardless of whether or not the assignment was done correctly (i.e., randomly). For whatever reason, a total of 193 students (14.6%) were incorrectly assigned by the schools to the wrong instruction method based on their day of birth. In addition, the correctness of assignment could not be determined for an additional 48 students (3.6%) for whom the information necessary to make this determination was missing. Because of the potential for self-selection bias when random assignment is not done correctly, a second set of analyses called "Correctly Assigned" is presented that compares only the 1,080 students in the four instruction methods who were correctly randomly assigned by the provider schools.

Two additional sets of analyses based on correctly-assigned students were conducted for the exit test knowledge and attitude outcomes which further divide the study subjects into groups based on whether they were simultaneously enrolled in driver training "Driver Training" or not "No Driver Training." These analyses were conducted to determine the influence of on-the-road training on the study results. Students enrolled in driver training were not compared on DMV written test pass rates because they take their written test before completing driver education instruction.

Two final sets of analyses were conducted for study exit examination knowledge and attitudes and also for the DMV written test. In these analyses, the students who did not simultaneously enroll in driver training were further divided into those who had access to a computer when they were assigned to an instruction method (and hence could have potentially been assigned to the CD-ROM program) called "Computer," and those who did not have access to a computer called "No Computer." These sub-analyses of the non-driver training students were conducted to determine if the pattern of performance across the courses was the same for students who did or did not have access to a computer. In particular, the students with access to a computer may have come from higher socio-economic status households and with more highly educated parents, and hence may have performed better, regardless of the instruction method, than the students who did not have computer access. Obviously, only the three

instruction methods not requiring a computer are compared in the “No Computer” sub-analysis.

Because the PEN course was added fairly late in the study, there was the possibility that comparisons of PEN students to those in the other instruction methods, some of whom had been assigned before PEN was in the study, would be biased by some sort of calendar effect. Supplementary analyses comparing correctly-assigned non-driver training PEN students to analogous students in the other courses assigned only after PEN was added were also conducted.

A supplementary analysis was also conducted for each outcome measure to determine if the pattern of differences/non-differences among the instructional methods varied as a function of the driver education provider school the students attended. Only students who were correctly randomly assigned and who did not enroll in driver training were included in these analyses. Further, only five provider schools had high enough volumes of these students to make a within-provider analysis meaningful. These schools were Sacramento Driving School, Roadrunner Driving School, Baldy View Driving School, Pegasus Driving School, and American/El Cajon Driving School.

Correlation of Outcome Measures

For descriptive purposes, study exit exam knowledge and attitude (CPI) scores and DMV written and drive test outcomes were correlated using a series of Pearson correlation coefficients. An alpha level of .05 was used to determine the statistical significance of each correlation. The results are shown in Table 3. For purposes of these analyses, DMV written and drive test pass rates were coded so that a higher value indicates passing the test.

Table 3

Correlations of Study Outcome Measures

Outcome measure	CPI attitude	DMV written test	DMV drive test
Exit exam knowledge	.03	.35*	.02
CPI attitude	–	.02	.04
DMV written test		–	-.17

Note. Higher DMV written and drive scores indicate a passing score.

* $p < .05$.

As can be seen from the table, the only statistically significant correlation among the outcome measures was a positive correlation between exit exam knowledge scores and DMV written test pass rate ($p < .05$). The meaning of this correlation is that students who had higher exit test knowledge scores also tended to pass the DMV written test.

This finding supports the concurrent validity of the exit test, given that both this test and the DMV written test overlap in some of the knowledge areas covered. The fact that none of the other outcome measures were correlated ($ps > .05$) suggests that they are indeed measuring different things. The somewhat surprising, although not statistically significant, negative correlation between DMV written and drive test outcomes is a result of the fact that of the 61 persons for whom a drive test outcome was available, only 5 (8.2%) passed the drive test on their first attempt, whereas 50 (82.0%) passed the written test on their first attempt. The very low variance in the drive test pass rates would tend to make any correlation with this outcome low and very unstable.

For the 721 study students included in the DMV written test comparisons, 479 (66.4%) passed the written test on their first attempt, which is about 15% higher than the 51.7% first-attempt pass rate for California teens in general, based on a recent evaluation by Chapman and Masten (2002). Given that the study pass rate reflects only students who did not enroll in driver training, and hence completed driver education before attempting their first DMV written test, the higher pass rate for study students probably indicates that completing driver education increases the likelihood that students will pass the DMV written test on their first attempt.

Time to Complete Each Course

For the 1,200 students who had valid course assignment and exit exam dates, the median number of days to course completion was calculated for each instruction method. The median number of days the students required to complete their study driver education course was 14 for classroom instruction, 49 for PEN, 30 for the CD program, and 31 for the workbook course. The higher median number of days for PEN students is surprising given that PEN charged additional fees to their students if the course was not completed within 30 days of issuance.

Exit Exam Knowledge Comparisons

For each of the statistical comparisons, Table 4 presents the sample sizes, mean exit exam knowledge scores, and standard deviations for each instructional method. The relationship among the exit exam knowledge means is illustrated in Figure 1. Table 5 presents results of the ANOVA for each of the six different statistical comparisons (Overall, Correctly Assigned, Driver Training, No Driver Training, Computer, and No Computer) and also the difference between the exit exam scores for the home-study and classroom courses. These mean differences were calculated by subtracting the classroom mean knowledge score from each home-study instructional method mean knowledge score. Hence, a negative mean difference indicates that classroom students had a higher mean level of knowledge on the exit exam, while a positive mean difference indicates that students in the home-study program had a higher mean

knowledge score. The mean home-study knowledge score differences that were significantly different from classroom according to the Tukey post-hoc tests are asterisked in Table 5.

The results indicate that students completing the PEN or CD courses either scored significantly higher on the knowledge portion of the exit exam, or did not significantly differ in knowledge level, compared to students taking a classroom course. Under no situation did the home-study students perform significantly worse than those who completed classroom instruction. Although there was some variation, this pattern of results was consistent across the six different statistical comparisons. For the analysis including all students, regardless of the correctness of assignment, both the PEN and CD-ROM students performed significantly better than those in classroom ($p < .05$). For correctly assigned students, only the CD-ROM students performed significantly better than classroom students ($p < .05$), although the results also suggested a trend that PEN students performed better than did classroom students ($p = .05$). For those who were correctly assigned and did not receive driver training, there were no differences between any of the home-study methods and classroom ($p > .05$). When the students were divided into those who did and did not have a computer, none of the home-study groups were significantly different from classroom, for either group ($p > .05$). For those who were correctly assigned and did receive driver training, only students who completed CD-ROM performed better than classroom students ($p < .05$). Students who completed the workbook did not differ significantly in exit exam knowledge levels compared to classroom students for any of the comparisons ($p > .05$).

There were also differences among knowledge levels of students completing the home-study courses. However, in no case did DMV workbook students perform better than those who completed the PEN and CD courses. In the analyses including all students, and only those correctly assigned, the PEN and CD students performed better than did those completing the workbook ($p < .05$). For students correctly assigned who did not enroll in driver training, the differences of PEN and CD students compared to workbook students were no longer statistically significant ($p > .05$). However, the direction of the results suggests a trend that PEN and CD students performed better than DMV workbook students ($p = .07$ and $.09$, respectively). When these students were further divided into computer and no computer groups, none of the home-study groups differed significantly ($p > .05$). For those who did take driver training, the CD students performed better than did the workbook students ($p < .05$), but PEN and workbook students did not differ significantly ($p > .05$).

Table 4

Mean Exit Exam Knowledge Score (M), Standard Deviation (SD), and Sample Size (n) for Each Driver Education Instruction Method by Statistical Comparison

Statistical comparison	Driver education instruction method											
	Classroom			PEN			CD-ROM			Workbook		
	M	SD	n	M	SD	n	M	SD	n	M	SD	n
Overall	27.57	4.13	305	29.22	4.14	114	29.42	4.36	412	28.01	4.65	490
<u>Correctly assigned</u>	27.86	4.16	198	29.25	4.19	101	29.36	4.38	363	27.82	4.65	418
Driver training	28.12	4.08	68	29.14	4.62	50	30.52	3.66	126	28.14	3.96	118
<u>No driver training</u>	27.72	4.21	130	29.35	3.77	51	28.59	4.59	227	27.63	4.92	292
Computer	28.41	4.09	71	29.40	3.77	45	28.59	4.59	227	27.92	4.72	154
No computer	26.90	4.23	59	29.00	4.05	6	-	-	-	27.31	5.13	138

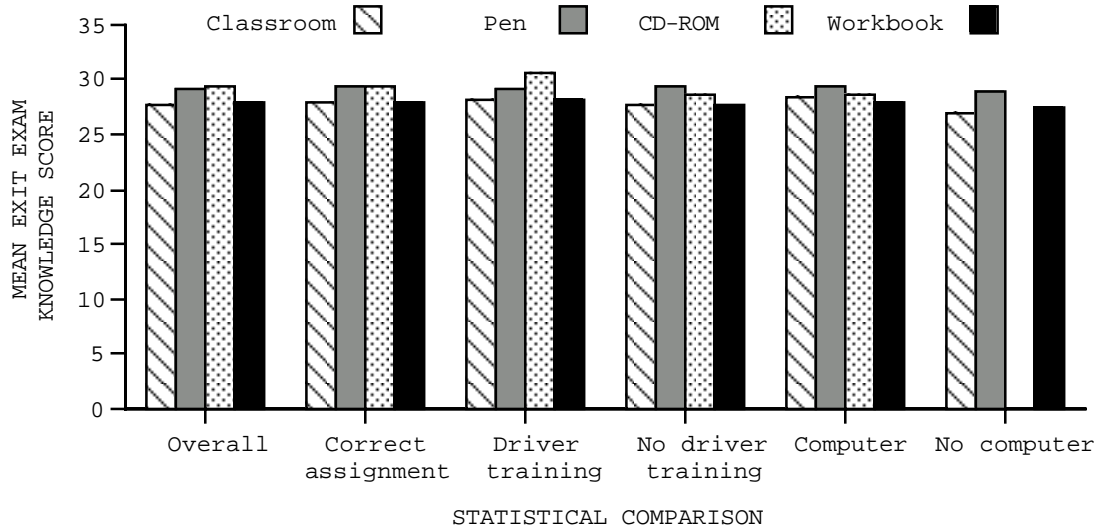


Figure 1. Mean exit exam knowledge scores by instruction method for each comparison.

Table 5

Comparisons of Home-Study Instruction Methods and Classroom Instruction on Exit Exam Knowledge Results

Statistical comparison	ANOVA				Mean difference ($M_{\text{Home-Study}} - M_{\text{Classroom}}$)			
	df_b	df_w	MSE	F	η^2	PEN	CD-ROM	Workbook
Overall ^a	3	1317	19.37	13.59*	.03	+1.65*	+1.85*	+0.43
<u>Correctly assigned</u> ^a	3	1076	19.62	10.17*	.03	+1.39†	+1.50*	-0.04
Driver training ^b	3	358	15.85	9.07*	.07	+1.02	+2.41*	+0.02
<u>No driver training</u>	3	696	21.27	3.42*	.02	+1.63	+0.87	-0.09
Computer	3	493	20.22	1.47	.01	+0.99	+0.19	-0.49
No computer	2	200	23.67	0.55	.01	+2.10	-	+0.41

^aPEN and CD-ROM were significantly better than the workbook. ^bCD-ROM is significantly better than the workbook.

* $p < .05$. † $p < .10$ (trend).

A supplementary analysis was also conducted comparing correctly assigned non-driver training students in PEN to comparable students in the other courses who were assigned only after PEN was added to the study. The results, not shown, were consistent with the other analyses, suggesting that there was no bias in the other PEN comparisons resulting from comparing them to students in the other instruction methods who had been assigned prior to the time PEN was introduced into the study.

The results, not shown, of the supplementary analysis used to determine if the relative effectiveness of the instruction methods varied across the providers did not indicate a statistically significant Instruction Method x Provider School interaction on exit exam knowledge scores ($p > .05$). Hence, the results discussed above were the same regardless of the provider school attended.

CPI Attitude Comparisons

A higher exit exam CPI attitude score indicates more of an internal locus of control, and that having a higher internal locus of control is associated with lower accident risk. Hence, a higher attitude score indicates a safer attitude for students to have after completing a driver education course. Table 6 presents the mean exit exam attitude scores, standard deviations, and sample sizes for each instructional method and statistical comparison. The attitude means are also shown in Figure 2. Table 7 presents the results of the ANOVAs and the mean difference between each home-study mean attitude score and the classroom instruction mean attitude score. Negative mean differences would indicate that classroom students had safer attitudes than did home-study students, whereas positive mean differences would indicate that the home-study students had better attitudes. The mean attitude differences that were significantly different from classroom are asterisked in Table 7.

Table 6

Mean CPI Attitude Score (M), Standard Deviation (SD), and Sample Size (n)
for Each Driver Education Instruction Method by Statistical Comparison

Statistical comparison	Driver education instruction method											
	Classroom			PEN			CD-ROM			Workbook		
	M	SD	n	M	SD	n	M	SD	n	M	SD	n
Overall	68.82	7.13	302	69.69	8.81	113	70.41	6.97	408	69.33	7.85	484
<u>Correctly assigned</u>	69.09	6.66	197	69.43	7.99	101	70.31	7.08	359	69.53	7.68	413
Driver training	69.69	6.90	68	67.78	8.38	50	69.59	6.76	124	69.47	7.22	117
<u>No driver training</u>	68.77	6.54	129	71.04	7.31	51	70.60	7.29	225	69.49	7.92	288
Computer	68.01	6.76	70	70.89	6.89	45	70.60	7.29	225	69.03	8.01	151
No computer	69.66	6.21	59	72.17	10.8	6	-	-	-	69.99	7.82	137

Note. Higher mean attitude scores indicate safer attitudes.

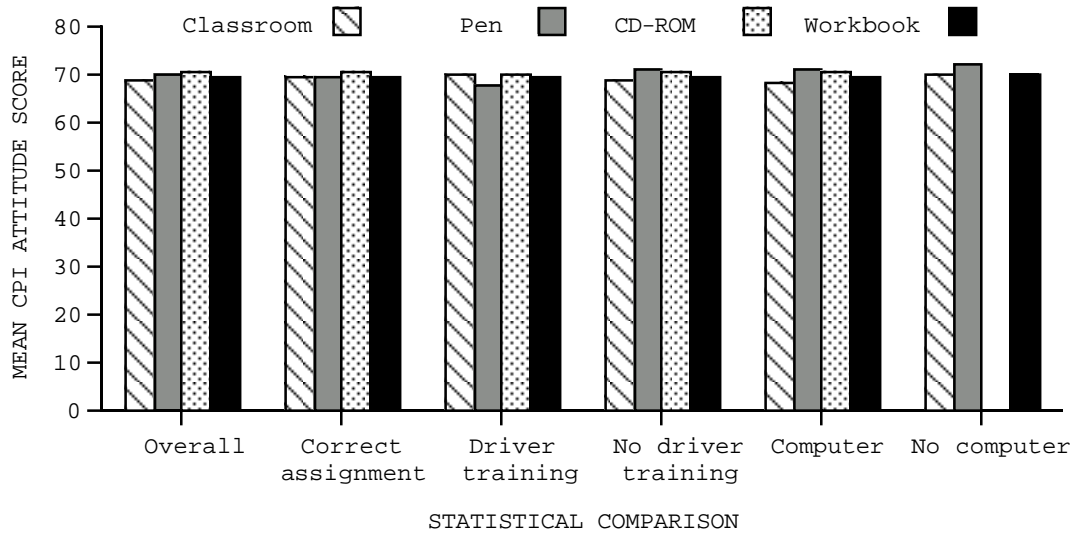


Figure 2. Mean CPI attitude scores by instruction method and statistical comparison.

Table 7

Comparisons of Home-Study Instruction Methods and Classroom Instruction on CPI Attitudes

Statistical comparison	ANOVA				Mean difference ($M_{Home-Study} - M_{Classroom}$)			
	df_p	df_v	MSE	F	η^2	PEN	CD-ROM	Workbook
Overall	3,	1303	56.41	2.90*	.01	+0.87	+1.59*	+0.51
<u>Correctly assigned</u>	3,	1066	53.78	1.43	.00	+0.34	+1.23	+0.44
Driver training	3,	355	51.55	0.90	.01	-1.91	-0.10	-0.22
<u>No driver training</u>	3,	689	55.22	2.34†	.01	+2.27	+1.83	+0.72
Computer	3,	487	54.93	3.09*	.02	+2.87	+2.59†	+1.02
No computer	2,	199	55.97	0.31	.00	+2.51	-	+0.32

* $p < .05$. † $p < .10$ (trend).

The results of the analyses on CPI attitude scores indicate only one significant difference between the classroom and home-study students. Specifically, for the analysis including all students, regardless of whether or not they were correctly assigned, those students completing the CD course had better attitudes than did those who completed the classroom course ($p < .05$). The results of the analysis that was limited to only correctly assigned student who did not take driver training and had access to a computer when they were assigned to an instruction method also suggested that the CD students had better attitudes than did classroom students ($p = .05$), although the difference just barely did not reach the less than .05 level required to be considered statistically significant. This finding may seem strange given that the PEN attitude mean is actually even higher than that for the CD course, however, the difference is not statistically significant ($p > .05$) because of the lower power involved in the PEN-to-classroom comparison due to PEN's smaller sample size. Statistical power refers to the

ability to detect a difference between the means when the difference actually does exist. None of the other home-study courses differed significantly from classroom or from each other ($ps > .05$). Therefore, with the possible exception of better attitudes for CD students, students who completed home-study driver education courses had attitudes that were similar to those completing classroom courses.

A supplementary analysis comparing correctly assigned non-driver training students in PEN to comparable students in the other courses who were assigned only after PEN was added to the study also did not indicate a significant difference between PEN and any of the other instruction methods ($ps > .05$).

The supplementary analyses used to determine if the relationships among the courses differed as a function of the provider school that the students attended did not indicate a statistically significant Instruction Method x Provider School interaction on CPI attitudes ($p > .05$).

First-Attempt DMV Written Knowledge Test Pass Rate Comparisons

The participants were also compared on their pass rates for their first DMV written test attempt. However, recall that teens who simultaneously enroll in behind-the-wheel driver training take their written test before they actually complete their driver education course. Therefore, only students who were not enrolled in driver training and who had actually taken the DMV written knowledge test since completing their driver education course were compared. In addition, not all of the students who did not take driver training had taken a written knowledge test at DMV to apply for their instruction permit by the time of this analysis. The number of non-driver training students missing a written test outcome was 18 (10.1%) for classroom instruction, 10 (18.5%) for the PEN course, 37 (14.6%) for the CD-ROM course, and 34 (10.2%) for the workbook course. Results of a chi square test of independence indicated that the missing written score rates were not significantly different among the four courses, $\chi^2(3, N = 820) = 5.37, p = .146$. The written test analyses are therefore based on the 721 students with a valid written test score who did not simultaneously enroll in driver training.

The number of students with a valid first attempt DMV written knowledge test score, and the number and percentage of these students who passed the test, are shown in Table 8 for each instructional method and statistical comparison. The percentages of students passing the courses are also shown in Figure 3. Results of the one-way ANOVA for each level of statistical comparison are presented in Table 9 along with the percentage-point difference between each home-study pass rate and the classroom instruction pass rate. Negative differences would indicate that a higher percentage of the classroom students passed the written knowledge test on their first attempt than did the home-study students in a particular course. Positive differences would indicate that a higher percentage of home-study students passed the written test on their first attempt than did the classroom students. The percentage point differences that were significantly different from classroom according to the Tukey post-hoc tests are asterisked in Table 9.

Three of the four ANOVAs comparing the DMV written knowledge test pass rates were statistically significant ($ps < .05$). Note that all of the percentage-point pass rate differences shown in Table 9 are negative numbers, indicating that students in the home-study courses all performed worse on their first written test attempt than did classroom students. However, not all of these differences were statistically significant. Specifically, results of Tukey post-hoc tests for the comparison including all students, regardless of the correctness of their assignment, indicated that for those students with a valid test score who did not simultaneously enroll in driver training, a higher percentage of students who completed the classroom instruction passed the written test on their first attempt compared to those who completed the CD-ROM course ($p < .05$). The percentages of students who passed the written test on their first attempt did not significantly differ between classroom and the PEN course, or classroom and the workbook course ($ps > .05$). However, the results did suggest that the workbook students performed worse than the classroom students on their first DMV written test ($p = .07$).

Table 8

Number of Non-Driver Training Students(n) with a Valid First Attempt DMV Written Knowledge Test Score and Percentage of Students Who Passed the Test for Each Driver Education Instruction Method by Statistical Comparison

Statistical comparison	Driver education instruction method							
	Classroom		PEN		CD-ROM		Workbook	
	n	%	n	%	n	%	n	%
Overall	160	75.6	44	65.9	217	62.7	300	64.3
<u>Correctly assigned</u>	115	78.3	44	65.9	193	60.6	262	64.1
Computer	65	81.5	39	66.7	193	60.6	142	65.5
No computer	50	74.0	5	60.0	-	-	120	62.5

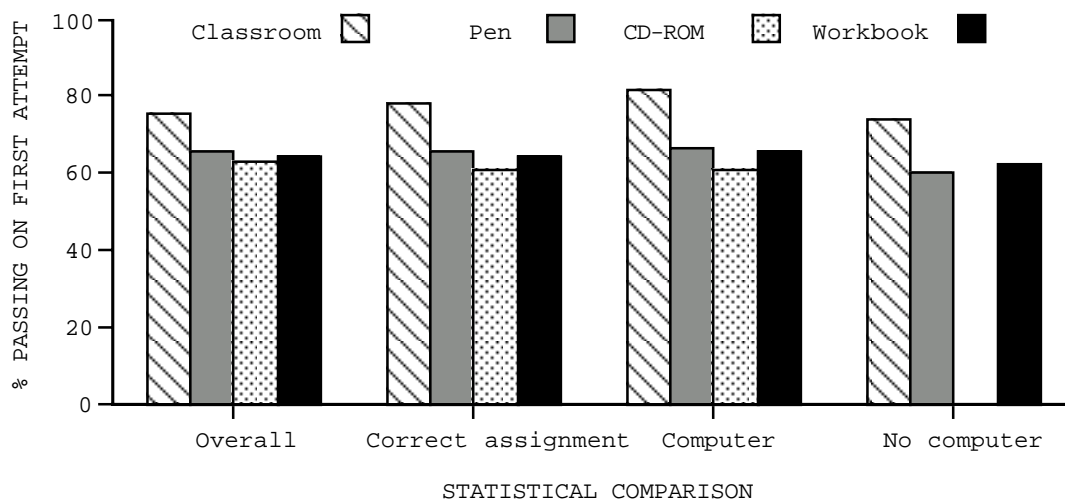


Figure 3. DMV written test pass rate by instruction method and statistical comparison.

Table 9

Comparisons of Home-Study Instruction Methods and Classroom Instruction on DMV Written Test First Attempt Pass Rate

Statistical comparison	ANOVA				Pass rate difference (% _{Home-Study} - % _{Classroom})		
	df_b, df_w	MSE	F	η^2	PEN	CD-ROM	Workbook
Overall	3, 717	0.22	2.69*	.01	-9.72	-12.95*	-11.29†
<u>Correctly assigned</u>	3, 610	0.22	3.56*	.02	-12.35	-17.64*	-14.14*
Computer	3, 435	0.22	3.20*	.02	-14.87	-20.92*	-16.05
No computer	2, 172	0.23	1.07	.01	-14.00	-	-11.50

* $p < .05$. † $p < .10$ (trend).

When the analysis was limited to students who were properly randomly assigned by the schools, the results indicated that students who did not simultaneously enroll in driver training and completed classroom instruction passed the written test at a higher rate on their first attempt than did students in either the CD or workbook courses ($ps < .05$). The pass rates for classroom and PEN students did not significantly differ from each other, and neither did any of the pass rates compared among the home-study courses ($ps > .05$). However, the fact that the observed 12.4% lower pass rate for properly-assigned PEN students was not statistically significant may be a result of low statistical power due to the small sample size of PEN students ($n = 44$) used in this comparison, rather than to there being no true difference between the groups' written test performances. For the properly assigned students with access to a computer, only the CD-ROM course was significantly worse than classroom ($p < .05$), and there were no differences among the pass rates for students in the courses when they did not have access to a computer. Again, finding that the PEN and workbook courses were not significantly worse than classroom in these analyses may be more a result of low power than to there truly being no difference. None of the home-study course pass rates were significantly different from each other in any of the analyses ($ps > .05$).

A supplementary analysis comparing correctly-assigned non-driver training students in PEN to comparable students in the other courses who were assigned only after PEN was added to the study also indicated no significant differences in written test performance, consistent with the other analyses ($ps > .05$).

The results of the supplementary Instruction Method x Provider School analysis did not indicate that the relative effectiveness of the instruction methods on DMV written test pass rates varied across the five provider schools included in the analysis ($p > .05$).

Course Evaluation Comparisons

Although not meaningful for comparing the relative effectiveness of home-study courses to classroom instruction, the exit examination also included five course evaluation questions. A description of the students' responses to these course evaluation questions is presented in this section. Responses to these questions could range from 1 to 6 with higher responses indicating a more positive evaluation of the course. The mean rating for each question is presented in Table 10 for each instruction method. The mean ratings shown in the table are based on students who were correctly

randomly assigned and successfully completed each course, and are presented for descriptive purposes only. Figure 4 also summarizes the ratings for each question. In general, there do not appear to be any important differences in the students' evaluations of the four instruction methods.

Table 10

Average Rating for Each Course Evaluation Question for Students who were Correctly Randomly Assigned and Completed each Method of Instruction

Question	Driver education instruction method			
	Classroom	PEN	CD-ROM	Workbook
How well did the course present the material in an interesting manner?	4.38	3.97	4.40	4.03
How easy was it to understand and follow the material used in the course?	4.17	3.95	4.30	4.07
How well did the course prepare you to begin driving?	4.88	4.84	4.86	4.84
Compared to what you knew about driving before the course, rate you current knowledge about driving.	4.90	4.78	4.88	4.90
Would you recommend the course to friends who still need to take driver education?	5.24	5.11	5.30	5.18

Note. Ratings are on a 1 to 6 scale where higher values indicate more agreement with the statement.

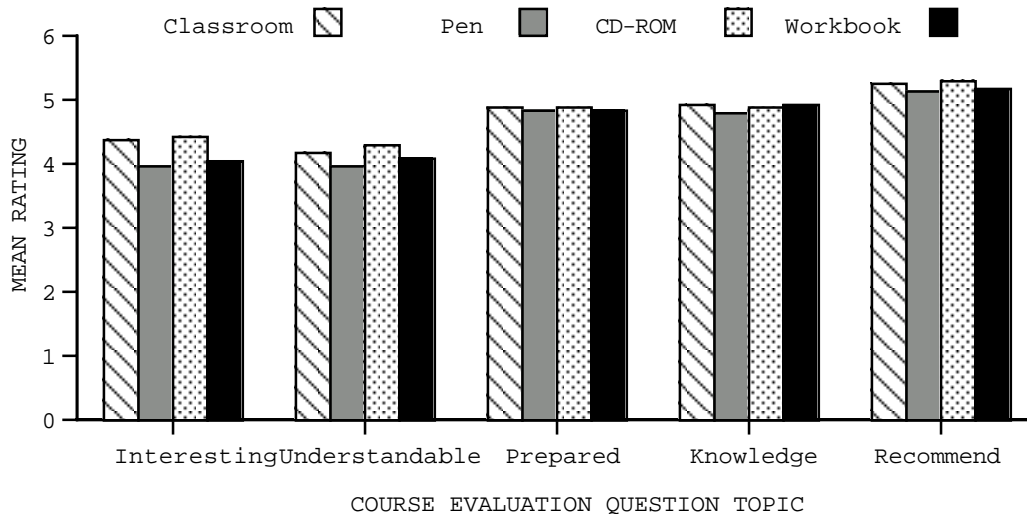


Figure 4. Mean course evaluation ratings for each question by instruction method.

DISCUSSION AND CONCLUSIONS

Home-Study Compared to Classroom Instruction

In this study numerous comparisons were made between classroom and home-study driver education courses. The findings provide no compelling evidence that the home study modes of instruction were inferior to classroom courses in teaching the driver education curriculum subject matter developed for the study. Rather, students taught under the home study options performed as well or significantly better on the study exit exam and the CPI safe driver attitude measure. However, classroom students did perform significantly better than home-study students on the DMV written test. These findings were generally consistent across the categories of analyses that were conducted. The fact that classroom students did better than home-study students on the DMV written test is considered less important in the determination of home-study driver education effectiveness than the finding that the classroom students performed the same as, or worse than, home-study students on the study exit exam, for the reasons specified below.

The main goal of driver education and training courses is to teach new drivers the knowledge, skills, and attitudes necessary for operating a motor vehicle safely and passing the written and behind-the-wheel driving tests required to obtain a driver license (Anderson et al., 2000; Mayhew & Simpson, 1990, 1996, 2002). To achieve these objectives, the DMV specifies the content of material that is to be taught to young drivers, particularly with regard to driver education courses. The California DMV created a standardized driver education curriculum that was the basis for all of the courses evaluated in this study, including the classroom courses. The content of the curriculum covers much more than is necessary to pass the DMV written test to obtain an instruction permit. That is, the DMV written test is a sample of only a very small portion of the standardized curriculum, and therefore only a very small portion of what is deemed important to be taught in a driver education course.

The knowledge portion of the study exit exam also represents only a sample of the standardized curriculum; to test students' knowledge levels of every detail of the entire curriculum would not have been practical. However, the exit exam represented a sample of the safety-related material from the entire standardized curriculum, and therefore measured the students' knowledge of a much larger set of safe driving material than is covered by the DMV written test. Because it covered much more of the material that the department deemed important for teens to learn, the exit exam is a much more content-valid measure of the material that is supposed to be taught in a driver education course than is the DMV written test. The exit test is deemed a more valid and reliable measure for three other reasons. First, the exit exam was pilot-tested to insure that it could discriminate between those with and without the requisite knowledge. Second, it occurred closer in time to the students' course completion and therefore was less subject to the students' studying and forgetting following completion of the course. Third, the content of the exit exam was kept secure by having DMV employees proctor the tests at the school sites. This final precaution would have prevented, for example, a particular course provider from learning the content of the exit exam and then focusing primarily on that subject matter in the course.

Even though the exit exam was considered to be a more valid measure of knowledge of the driver education curriculum, and the home-study courses were as effective as the classroom courses in teaching this material, the classroom courses were clearly superior to home study courses in preparing students to pass the DMV written test. One possible explanation for this is that classroom instructors may have focused more on the actual questions on the DMV's exam.

The higher percentage of students who did not complete the classroom and PEN courses could have biased some or all of the comparisons in favor of students who completed these courses, especially those completing PEN, given the higher dropout rate for this instruction method. However, any favoring of classroom over home study as a result of its higher course noncompletion rate did not make classroom students perform better than home-study students on the study exit exam.

The findings that home-study courses are at least as effective as classroom courses in teaching the driver education curriculum offers support for allowing the use of home-study driver education as an option in California. The results indicate that computer-based courses may be more effective than strictly paper-based workbook courses; however, even students who completed the workbook course performed as well as classroom students on the study exit exam.

Improvement of Driver Education

The findings of this evaluation also shed light on the usefulness of computer-based methods of teaching driver education as compared to other methods. The evidence suggests that students who completed the courses involving computer-based and internet instruction performed better on the study exit examination than did those in the purely paper-based workbook course and the classroom courses. There is even evidence that computer courses can be effective in improving student attitudes about safe driving. The use of interactive technology has been recommended by some traffic safety researchers as a way of improving the effectiveness of driver education in general, and these findings provide support for this view.

The traffic safety researchers have also recommended ways to improve driver education and training by integrating them with existing graduated licensing programs. Specifically, they recommend that driver education and training be multi-staged, with a basic driver education course before teens learn how to drive and an advanced course after they have gained some experience driving on the road. More complex topics, such as risk perception, might be better taught in the advanced course where experience on the road might make these topics more understandable. Two possible roadblocks to implementing such a two-staged system would be the prohibitive cost and time requirements of multiple courses on parents. Finding that home-study, particularly the computer based courses, were effective educational methods for driver education, suggests that the use of the home-study courses as part of a two-staged driver education system may make such a system feasible. Such courses, once made, should be relatively inexpensive, therefore placing minimal demand on the finances and time of parents. Home-study courses may also have the additional benefit of increasing

parental involvement in their teen's learning process, which has been shown to be an important factor in the effectiveness of graduated licensing laws in general.

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APPENDICES

Appendix A

Senate Bill 946 (Study Legislation)

BILL NUMBER: SB 946 CHAPTERED
BILL TEXT

CHAPTER 206
FILED WITH SECRETARY OF STATE JULY 28, 1999
APPROVED BY GOVERNOR JULY 27, 1999
PASSED THE ASSEMBLY JULY 15, 1999
PASSED THE SENATE JUNE 1, 1999
AMENDED IN SENATE MAY 12, 1999
AMENDED IN SENATE APRIL 6, 1999

INTRODUCED BY Senator Vasconcellos

FEBRUARY 25, 1999

An act to add and repeal Section 12814.8 to the Vehicle Code, relating to vehicles.

THE PEOPLE OF THE STATE OF CALIFORNIA DO ENACT AS FOLLOWS:

SECTION 1. Section 12814.8 is added to the Vehicle Code, to read:

- 12814.8. (a) The department shall conduct a pilot study of persons under 18 years of age to compare the effectiveness of driver education programs conducted in a nonclassroom environment with classroom-based programs.
- (b) For the purpose of this section, the following definitions apply:
- (1) "Driver education" is automobile driver education, as described in subdivision (j) of Section 51220 of, and Section 51220.1 of, the Education Code.
 - (2) "Exit examination" is a test designed by the department and administered to each participant in the study to evaluate traffic safety knowledge and driver attitude.
 - (3) "Private school" is any entity that has complied with Section 33190 of the Education Code.
- (c) The department shall select a number of providers to participate in the study to ensure that each of the following categories of programs are adequately represented:
- (1) A driver education program delivered in a classroom environment under the direct supervision of an instructor as required in Chapter 1 (commencing with Section 11100) of Division 5.
 - (2) A driver education program that uses printed materials or computer-based delivery methods, or both, that meets all of the following requirements:

- (A) The program has operated using a nonclassroom format for not less than four years.
 - (B) The program has provided a minimum of 2,000 hours of driver education, as described in subdivision (j) of Section 51220 of the Education Code, and the principal of the school holds a driving school operator's license issued by the department.
 - (C) Is a California private secondary school.
- (3) A driver education program licensed under Chapter 1 (commencing with Section 11100) of Division 5 selected by the department to present a nonclassroom course utilizing printed materials based upon a model curriculum approved by the department.
 - (4) A driver education program licensed under Chapter 1 (commencing with Section 11100) of Division 5 selected by the department to present a nonclassroom course utilizing an interactive, computer-based program that follows a model curriculum approved by the department.
- (d) The department shall require the selected providers to do all of the following:
 - (1) Submit to the department a statement that the school, if applicable, is in compliance with Section 33191 of the Education Code.
 - (2) Maintain on file a release statement signed by the parent or guardian of each student in the study permitting the release of information deemed by the department to be relevant to the completion of the study. The form and contents of the release statement shall be determined by the department.
 - (3) Provide, at no cost to the department, on a schedule to be determined by the department, information pertaining to the provider's students, including, but not limited to, the student's true full name, the student's birth date, the certificate number, and the date the certificate was issued. All information provided to the department that identifies a specific individual participating in the pilot project shall be kept confidential. All data collected pursuant to this section shall be used only for the purposes of the pilot project.
 - (4) Maintain all records and proof of compliance under the terms of this section as follows:
 - (A) Records shall be available for inspection during regular business hours at the principal place of business of the provider by an authorized representative of the department.
 - (B) Individual records for pilot project participants shall not be requested prior to the 10th working day following completion of the course, and inspections may not take place on Saturdays, Sundays, and legal holidays.
 - (C) Providers need not retain records for purposes of inspection under this pilot project after January 1, 2004.
- (e) The department shall include not less than 8,000 students in the pilot project, with approximately 2,000 participants in each of the groups described in subdivision (c).
 - (f) The department shall employ a consultant group with established expertise in designing and evaluating driver education curricula for the purpose of developing the curriculum and program standards to be used in this pilot project.

- (g) The department shall develop, to the greatest extent possible, a system which randomly assigns students to the programs to be studied during the pilot period.
- (h) In order to facilitate the progress of this project, the department shall release all necessary certificates, forms, and booklets to the providers in a timely manner.
- (i) The department shall compare the results of exit examination, and the pass and fail rates for written tests and driving tests, of study participants.
- (j) Persons participating in this pilot project who meet the course requirements for a certificate of completion shall be deemed to have complied with the automobile driver education requirements for a provisional driver's license pursuant to Section 12814.6.
- (k) The department shall collect the data to be used in this pilot project during the period beginning on January 1, 2001, and ending on December 31, 2002.
- (l) Notwithstanding Section 7550.5 of the Government Code, and subject to subdivision (m), the department shall submit a report of the results of the pilot project to the Legislature not later than May 31, 2003.
- (m) The execution and transmission of the final report specified in subdivision (l) is contingent on the department's ability to obtain sufficient numbers of program providers and student applicants as required under this section. If the number of participants specified in subdivision (e) is not obtained, the department shall recommend the termination of the pilot project by notifying the Legislature of this fact in writing not later than January 1, 2002.
- (n) Nothing in this section shall be construed to impede the ability of any provider selected for this pilot project to continue to provide services to persons who are not participants in the pilot project.
- (o) This section shall remain in effect only until January 1, 2004, and as of that date is repealed, unless a later enacted statute, that is enacted on or before January 1, 2004, deletes or extends that date.

Appendix B

Parent/Guardian Release Statement



PARENT/GUARDIAN RELEASE STATEMENT

_____ is participating in a Department of Motor Vehicles (DMV) study of the effectiveness of home-study driver education instruction methods for applicants under the age of 18 **only**. If you choose to let your child participate in the study at this school and they meet the eligibility criteria, he or she will be randomly assigned by the DMV to receive one of the following four types of driver education instruction:

- Traditional in-person classroom instruction
- A model paper-based home-study course
- A computer CD ROM home-study program
- An alternative home-study kit

The fee for the instruction as part of the study will be \$_____, regardless of the type of instruction your child is assigned to receive. You will be notified of the type of instruction your child will receive after submitting this signed form and the course fee to the school. Completion of any of the home-study courses will satisfy the legal requirement for a 30-hour classroom driver education course. Your child should complete the assigned course within **30 days** of the date they receive the course.

After your child completes the course of instruction to which he or she is assigned, he/she must come to _____ on the first _____, following the course completion between _____ and _____ to take a DMV-proctored exit examination. The test will take about 20-30 minutes to complete. The exit examination must be taken within 5 to 10 business days of when your child completes the course. The results of this examination will be used by the DMV to evaluate the effectiveness of home-study driver education.

If your child does not have access to a computer with the minimum hardware and software requirements (listed below), he or she will be randomly assigned by DMV to receive one of the non-computer instruction methods.

If you don't want your child to participate in the study or your child does not meet the requirements, he or she may take the usual classroom-based course for the fee of \$_____. If you pay to enroll your child in the study and then refuse to complete the study and testing requirements for any reason, you will **not** be given a refund.

PLEASE ANSWER THE FOLLOWING QUESTIONS AND SIGN BELOW

I have read the above information and declare that my minor child, _____, was born on ____/____/____, the last four digits of his/her Social Security Number* are ____/____/____, and:

Please check one of the following:

- May participate in the study. I understand that my child will be randomly assigned to receive one of the above types of driver education instruction and attest that he or she will complete the course to which he/she is assigned, follow all study requirements (including the exit examination), and can read and understand English at or above the 7th grade level. I give my permission for the school indicated above to release to the DMV all information necessary for completion of the evaluation.
- May **not** participate in the study. I understand the fee for a regular classroom Driver Education course may be different than the amount charged for the Driver Education courses in this study, and agree to pay the different fee.

Below are the minimum hardware and software requirements for the computer-based instruction program.

Please check one of the following:

- My child has access to a computer with all of the following:
- A Pentium 75 MHZ or better processor
 - 32MB or more of RAM
 - A CD ROM drive and mouse
 - A sound card and printer
 - VGA or better video
 - Windows 9x or higher
- My child does not have access to a computer that meets the minimum hardware and software requirements.

I certify under penalty of perjury under the laws of the State of California that the information provided by me is true and correct.

PARENT/GUARDIAN SIGNATURE

DATE

CHILD'S SIGNATURE

DATE

*Providing the last four digits of your child's Social Security Number is voluntary and will be used for research purposes only.

Distribution: Original: DMV

Yellow: School

Pink: Parent/Guardian



Appendix D

Exit Examination

Correct answers to the knowledge items are in boldface

Exam Form #1



Department of Motor Vehicles Driver Education Exit Examination



Do not write anywhere in this exam booklet

Please fill-out the information at the top of the separate answer sheet before beginning the exam. The exam form number is located on the front cover of this exam.

When completing the exam questions make all your marks on the separate answer sheet. Do not make any marks in this exam booklet.

You must provide all information requested at the top of the answer sheet and answer all 60 questions in order to receive your Certificate of Completion of Classroom Driver Education.

The next 40 questions are based on the material covered in your driver education course. Please read and answer each question, choosing the answer that is the most correct for general driving situations. Only mark one answer for each question.

- 1 When changing lanes you need to check for vehicles in your blind spots by looking:
 - a. In your inside rearview mirror
 - b. In both your inside and outside rearview mirrors
 - c. **Over your shoulder into the lane you want to enter**

- 2 Which one of the following statements is true about driving habits and attitudes?
 - a. **Only training and repeated practice can overcome poor driving habits and attitudes**
 - b. If you establish good driving habits and attitudes now, you will not have to worry about losing them in the future
 - c. Once a bad habit or attitude is established, it cannot be changed if you have been driving for a long time

- 3 Depth perception is necessary for which one of the following driving tasks?
 - a. **Maintaining a constant speed in relation to other vehicles**
 - b. Identifying objects ahead when driving towards bright sunlight
 - c. Recognizing upcoming road signs at an appropriate distance

- 4 Peripheral vision is necessary for which one of the following driving tasks?
 - a. Seeing the details of objects ahead of your vehicle
 - b. **Monitoring the position of your vehicle in the lane**
 - c. Identifying low-contrast objects behind your vehicle

- 5 When you stop your vehicle suddenly by hard braking, the force of inertia causes your:
 - a. Tires to grip the road and make your vehicle stop
 - b. Vehicle to pull to the left or right instead of going straight
 - c. **Body and loose objects in the vehicle to fly forward**

- 6 Two sets of solid double yellow lines that are two or more feet apart and divide opposing lanes of traffic may:
 - a. Be crossed to make a left turn from or into a driveway or side street
 - b. Be used to begin U turns as long as it is not in a business district
 - c. **Not be crossed for any reason**

- 7 Which of the following is true about road signs?
 - a. Regulatory signs must be obeyed, but not warning signs
 - b. Warning signs and informational signs must be obeyed
 - c. **Regulatory signs and warning signs must be obeyed**

- 8 Solid white lines that divide lanes of traffic going in the same direction may:
 - a. **Not be crossed for any reason**
 - b. Be crossed to change lanes
 - c. Be crossed to make a turn

- 9 For licensed persons under age 21, a first conviction for using alcohol or illegal drugs anywhere results in:
 - a. **License suspension for 1 year**
 - b. Restricting your license to driving to and from work only
 - c. Automatic jail time and 18-months of license suspension

- 10 For the first year after obtaining a license, drivers under the age of 18 are restricted from driving:
 - a. With any other passengers, regardless of their age
 - b. On freeways with speed limits of 65 MPH or higher
 - c. **Between midnight and 5 a.m.**

- 11 If you are involved in a traffic collision, you must present your driver license information to:
- Other persons involved in the accident and law enforcement**
 - Your insurance company agent and law enforcement
 - Law enforcement only
- 12 The most important gauge or warning light on the instrument panel is:
- Temperature**
 - Oil level
 - Voltage
- 13 Reduced traction and poor vehicle handling are caused by:
- Over-inflating the tires only
 - Under-inflating the tires only
 - Either over- or under-inflating the tires**
- 14 Which of the following statements is true about air bags?
- Driver-side air bags should be disabled for drivers over 70 years of age
 - They are most effective if you sit at least 10 inches from the steering wheel**
 - They offer the same protection as seatbelts in most accidents
- 15 You should signal during the last 100 feet before making a turn:
- Unless you don't think there are other vehicles around
 - Except when turning from a center left-turn lane
 - Always, no matter what the circumstances are**
- 16 If you are driving the speed limit in the left (fastest) lane of a four-lane freeway and vehicles are following close behind:
- You should stay in your lane and let the other vehicles pass on the right
 - You should flash your brake lights to warn the other drivers to back off
 - You should change lanes to let the other vehicles pass**
- 17 When entering an uncontrolled "T" intersection, who has the right of way?
- Traffic on the through road**
 - Traffic on the terminating road
 - Always the vehicle on the right
- 18 If there is a bicycle lane to the right of your lane, and you want to turn right into an upcoming driveway, you should:
- Merge into the bicycle lane before starting your turn**
 - Merge into the bicycle lane before starting your turn only if there is no white dividing line
 - Make your turn without first merging into the bicycle lane
- 19 Unless prohibited by a sign, you may legally make a U-turn at an intersection only if:
- It can be completed without interfering with oncoming traffic
 - You can see oncoming traffic for at least 300 feet and are not in a business district
 - A traffic signal or stop sign protects you from oncoming traffic**
- 20 If your gas pedal gets stuck while you are driving, the first thing you should do is:
- Shift to neutral**
 - Turn off the ignition
 - Apply the brakes

- 21 To recover from an acceleration skid, you should ease off the gas and:
- Do not apply the brakes**
 - Firmly apply the brakes
 - Lightly apply the brakes
- 22 If you must drive through a large amount of water on the road, you should:
- Drive through quickly to avoid having your engine stall
 - Drive slowly to avoid water splashing into the engine compartment**
 - Maintain a constant fast speed to avoid being swept away by the current
- 23 To avoid a side-swipe accident when changing lanes, the most important place to check for other vehicles is:
- In your inside rearview mirror
 - Over your shoulder in the lane you want to enter**
 - In your outside rearview mirrors
- 24 On a road with one lane in each direction, you see that you will pass a pedestrian ahead at the same time that you will pass an oncoming truck. You should:
- Adjust your lane position to be somewhat closer to the oncoming truck than the pedestrian
 - Adjust your lane position to be somewhat closer to the pedestrian than the oncoming truck
 - Adjust your speed to avoid passing the pedestrian and oncoming truck at the same time**
- 25 In an emergency driving situation:
- It is always better to brake than to try to steer around a hazard
 - It is always safer to swerve into another traffic lane than to risk a skid
 - It is often better to steer around a hazard than to try to stop**
- 26 What part of the roadway is likely to be the most slippery when the weather is wet and very cold?
- Long stretches of open roadway
 - The middle of intersections
 - Areas shaded by trees and buildings**
- 27 If both of your low-beam headlights go out while driving at night on a busy road, you should:
- Turn on your high-beam headlights and continue driving
 - Turn on emergency flashers and continue driving
 - Turn on your parking or emergency lights, and pull off the road**
- 28 You are driving defensively if you:
- Constantly anticipate the possibility of a dangerous situation developing**
 - Stay close to or alongside other vehicles
 - Assume that other drivers are sober, alert, and will follow the rules of the road
- 29 If you are being passed on the left by another driver that was behind you on a road with one lane in each direction, you should slow down and drive:
- In the center of your lane
 - Near the right edge of your lane**
 - On the right shoulder of the road

- 30** Defensive drivers always:
- Leave space for making emergency maneuvers**
 - Yield their legal right-of-way to other traffic
 - Drive within 5 MPH of the posted speed limit
- 31** Which of the following is true about bicycle lanes?
- Vehicles must never drive in bicycle lanes, even for short distances
 - Vehicles must merge into bicycle lanes before making right turns**
 - Vehicles may not park in bicycle lanes under any circumstances
- 32** Blind spots of large trucks are often referred to as the “No Zone” because you:
- May not drive through these areas
 - Should avoid driving in these areas**
 - Know the driver can see you in these areas
- 33** You are approaching a school bus with flashing red lights that is stopped on the other side of an undivided two-lane road. You must:
- Slow to 15 MPH or less and proceed with caution
 - Stop and then cautiously proceed at 15 MPH as you pass
 - Stop and not proceed until the lights stop flashing**
- 34** You are approaching a red traffic light, but a law enforcement officer is signaling for you to continue through the intersection. You should:
- Slow down and continue through the intersection without stopping**
 - Stop completely before entering the intersection, then continue through
 - Stop and wait for the light to turn green before entering the intersection
- 35** At an intersection controlled by traffic signals, but without pedestrian signals, pedestrians:
- Are not permitted to cross the roadway
 - May enter the crosswalk only after all vehicles have proceeded through the intersection
 - Must obey the same signal lights as vehicles**
- 36** A vehicle you are approaching in the lane to your right is stopped at a crosswalk. You do not see any pedestrians. You should:
- Stop before you enter the crosswalk**
 - Slow down and carefully pass the other vehicle
 - Slow to 25 MPH before you pass the other vehicle
- 37** It is legal to park your vehicle:
- Across a sidewalk
 - In a bicycle lane**
 - In an unmarked crosswalk
- 38** When you encounter an emergency vehicle with flashing lights and a siren on, you must immediately pull to the right edge of the road and come to a complete stop:
- Under all circumstances and conditions
 - If you are in the rightmost lane of a multi-lane freeway
 - As long as you are not in the middle of an intersection**

- 39 Drinking alcohol:
- Raises your inhibitions
 - Slows mental processes**
 - Improves reaction time
- 40 California's driving-under-the-influence (DUI) laws relate:
- Only to being under the influence of alcohol
 - Only to being under the influence of illegal drugs or alcohol
 - To being under the influence of alcohol or any drug (legal or illegal)**

The next 15 questions are based on your attitudes about different driving situations. Because these questions are based on your personal beliefs, there are no right or wrong answers. Read the following statements and indicate to what extent you agree or disagree with each one. To the right of each statement is a scale that ranges from *Strongly Disagree* (1) to *Strongly Agree* (6). Higher numbers indicate that you agree with a statement more. Please answer EVERY statement and mark ONLY ONE answer choice per statement on the separate answer sheet.

		1	2	3	4	5	6
		Strongly Disagree	Mostly Disagree	Slightly Disagree	Slightly Agree	Mostly Agree	Strongly Agree
Item	Statement	<i>Strongly Disagree</i>					<i>Strongly Agree</i>
41	Accidents occur because drivers don't drive as safely as they should.	1	2	3	4	5	6
42	It is possible to avoid accidents even under the most difficult driving conditions, such as bad weather or heavy traffic.	1	2	3	4	5	6
43	Accidents are usually due to bad luck or circumstances beyond the driver's control rather than their failure to be attentive.	1	2	3	4	5	6
44	Accidents happen when drivers don't take into consideration the possible actions of other drivers.	1	2	3	4	5	6
45	You will be safe while driving if you follow all traffic laws.	1	2	3	4	5	6

Item	Statement	<i>Strongly Disagree</i>					<i>Strongly Agree</i>
46	Your state of mind while driving will not affect the likelihood of you being involved in an accident.	1	2	3	4	5	6
47	If all drivers were attentive and careful, there would be many fewer accidents.	1	2	3	4	5	6
48	Avoiding accidents and traffic tickets is largely a matter of luck.	1	2	3	4	5	6
49	No matter how carefully someone drives, eventually they will be involved in an accident.	1	2	3	4	5	6
50	Enough driving experience will make anyone a safe driver.	1	2	3	4	5	6
51	Most traffic laws are unnecessary and only make driving more difficult.	1	2	3	4	5	6
52	Exceeding the posted speed limit is always dangerous.	1	2	3	4	5	6
53	Road rage is usually caused by another driver being inconsiderate or careless.	1	2	3	4	5	6
54	Accidents are the result of mistakes made by drivers.	1	2	3	4	5	6
55	If your parents got into a lot of auto accidents, so will you when you drive.	1	2	3	4	5	6

The following 5 questions are based on your opinions about the driver education course you completed. Your responses will help DMV evaluate the quality of the course. Read the following questions and then circle the number on the 6-point scale that represents your belief. Please answer EVERY question and mark ONLY ONE answer choice per question on the separate answer sheet. There are no right or wrong answers.

Item	Statement	Tell us what you think					
56	How well did the course present the material in an interesting manner?	1 Not At All	2	3	4	5	6 Very Well
57	How easy was it to understand and follow the materials used in the course?	1 Very Easy	2	3	4	5	6 Very Difficult
58	How well did the course prepare you to begin driving?	1 Not At All	2	3	4	5	6 A Lot
59	Compared to what you knew about driving before the course, rate your current knowledge about driving:	1 Same	2	3	4	5	6 A Lot More
60	Would you recommend the course to friends who still need to take driver education?	1 Absolutely Not	2	3	4	5	6 Absolutely Yes

Before you return your exam and answer sheet to the proctor, please make sure you have filled in all the information at the top of the answer sheet, including your name, today's date, the type of driver education course you took, and the exam form number. Next, make sure that you have marked an answer for each exam question on the separate answer sheet and have left no marks in the exam booklet.

After you return the exam materials and receive your Certificate of Completion of Classroom Driver Education, you are free to go.

Thank you.

Appendix E

Number of Valid Study Students From Each Participating Provider School

School name and number	Number of valid students
Sacramento Driving School #2905	265
Roadrunner Driving School #2562	177
Baldy View Driving School #2479	131
Kay-1 Driving School #2929	124
Pegasus Driving School #3291	114
American/El Cajon Driving School #3348	102
Drillers Driving School #3271	50
Behind the Wheel Driving School #3336	47
Elischer's Driving School #2359	42
Cottonwood Driving School #3657	40
Safety First Driving School #3832	24
Bakker's Driving School #3246	21
Chico Driving School #3661	21
B. J. Driving School #3417	17
A-1 Economy Driving School International #3225	16
A-Safe Way Driving School #3164	16
Capitol City Driving School #3555	15
Kim's Driving School #4692	15
Delta Driving School Inc. #2768	14
Loves Safe Driving School #3628	13
Advanced Driving School #3220	10
A-Steve Morris' Defensive Driving School #4701	10
Mac's Driving School #3386	9
Raasveld Instructional Services #3595	9
Stanford Driving School #3198	6
Ace Driving School #2711	5
Sweet Sisters Driving School #3527	5
A Clovis Driving and Traffic School #3544	3
Budget Driving School #3087	0
Davis Academy Driving School #3501	0
Dootson Driving School # 4208	0
Easy Driving School #2753	0
Laguna Beach Driving School #2545	0
Total	1,321